AIR FORCE
QUALIFICATION TRAINING PACKAGE (AFQTP)

FOR

LIQUID FUEL SYSTEMS MAINTENANCE

(3E4X2)

MODULE 20

AFSC SPECIFIC CONTINGENCY RESPONSIBILITIES

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MODULE 20

AFSC SPECIFIC CONTINGENCY RESPONSIBILITIES

Career Field Education and Training Plan (CFETP) references from 1 Jul 02 version.

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LIQUID FUEL SYSTEMS MAINTENANCE
(3E4X2)

INTRODUCTION

Before starting this AFQTP, **refer to and read the "AFQTP TRAINER/TRAINEE GUIDE."**

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks*.*

MANDATORY minimum upgrade requirements:

Core task:
AFQTP completion
Hands-on certification

Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note*: Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location*.

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

POL DISTRIBUTION SYSTEM REPAIR

RAPID UTILITY REPAIR KIT (RURK)

MODULE 20 **AFQTP UNIT 1**

OPERATE/MAINTAIN RURK I (20.1.3.2.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

OPERATE/MAINTAIN RURK 1

Task Training Guide

STS Reference Number/Title:	20.1.3.2., Operate/Maintain RURK I.
Training References:	1. CD-ROM, Air Force Qualification Training Package (AFQTP) 3E4X2, Liquid Fuel Maintenance (LFM), Version 1.0, May 97: *POL Rapid Utility Repair Kit (RURK)*. 2. Technical Order (T.O.) 35D26-9-2-1, *Organizational Maintenance POL Rapid Utility Repair Kit System (POL RURK).* 3. T.O. 35C2-3-499-1, *Generator Set Diesel, 3kW. MDL 30 D36R.* 4. T. O. 11H5-35-1, *Alarm System, Combustible Gas, and Oxygen Indicator, Automatic.* 5. T.O. 34Y1-258-1, *Compressor, Rotary, Diesel Engine.* 6. T.O. 35F5-5-16-1, *TF-1 Lighting Assembly.* 7. Tanner System, Inc. Deicer Model T-83 commercial manual. 8. Video # 611404, The POL Pipeline RURK, Aug 1992. 9. Career Development Course (CDC) 3E452 Liquid Fuel System Maintenance, Volume 3, Unit 1-1: *Petroleum, Oils, and Lubricants Rapid Utility Repair Kit I.*
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC.** 2. **Review the following references:** 2.1. T.Os. 35D26-9-2-1, 35C2-3-499-1, 11H5-35-1, 34Y1-258-1, and 35F5-5-16-1. 2.2. Tanner System, Inc. Deicer Model T-83 manual. 2.3. Video # 611404. 2.4. CDC 3E452 Liquid Fuel System Maintenance, Volume 3, Unit 1-1. 3. **Complete CD-ROM, AFQTP 3E4X2, LFM, Version 1.0, May 97: *POL RURK.***
Equipment/Tools Required:	1. Computer to support CD-ROM AFQTP. 2. RURK I. 3. Common toolbox.
Learning Objective:	Given T.O. 35D26-9-2-1, trainee should know basic operation of the POL RURK I.
Samples of Behavior:	Trainee will be able to service/maintain, set-up/operate, and repair damaged pipelines using the RURK I in a contingency environment.
Notes:	
1. To successfully complete this element, the steps must be followed exactly--no exceptions. 2. Any safety violation is an automatic failure. 3. You **must** follow the detailed procedures in T.O. 35D26-9-2-1, *Organizational Maintenance POL RURK,* when serving, maintaining, setting up, and repairing damaged pipelines. The type of repairs and individual components requires specific step-by-step procedures when unpacking and setting up, and repairing POL pipelines.	

OPERATE/MAINTAIN RURK I

1. Background: In today's world of fast paced contingency, it is critical that Liquid Fuels Maintenance Specialists be able to repair pipelines quickly and accurately. This ensures aircraft the ability to strike in a moment's notice and be provided with a clean, uninterrupted supply of fuel.

1.1. A Petroleum, Oil, and Lubricant (POL) Rapid Utility Repair Kit (RURK) (figure 1) consists of an open-bed trailer with an equipment rack containing various equipment, a 3,000-gallon collapsible fabric tank, an air compressor, and five containers (four consolidated and one supplemental). The four consolidation containers provide the capability to perform one in-crater repair, three bypass repairs, and one 4-way valve pit repair for 4-, 6-, or 8-inch pipe. The supplemental container provides components to support repairs for 10- and 12-inch pipe, puncture repair for 4- through 12-inch pipe, and additional repairs for 4-, 6-, and 8-inch pipe.

1.2. The POL RURK is delivered to user organizations as an open-bed trailer preloaded with four component containers along with seven supplemental containers, a compressor, and three fabric tanks. The RURK is store indoors as a war reserve material (WRM) asset.

Figure 1. POL RURK

1.3. Five types of repair are possible:

1.3.1. ***In-crater repairs*** are accomplished by entering the crater, sawing off damaged pipe ends, and attaching various hoses and pipes to establish flow and pressure (figure 2).

Figure 2. In-crater Repair

1.3.2. ***Bypass repairs*** serve the same purpose, but are accomplished by exposing undamaged pipe on each side of, but away from, the crater edge (figure 3).

Figure 3. Bypass Repair

1.3.3. ***Valve pit repairs*** can be either in-crater or bypass except valves are included so fuel flow can be controlled and/or directed (figure 4).

Figure 4. Valve Pit Repair Components

1.3.4. A pipe ***end cap repair*** is used to block a pipe (figure 5).

Figure 5. End Cap Repair

1.3.5. A ***puncture repair*** uses a repair clamp to cover a hole in a pipeline small enough not to require removing a section of pipe (figure 6).

Figure 6. Puncture Repair

2. Complete the CD-ROM, AFQTP 3E4X2 LFM, Version 1.0, May 97: POL RURK for detailed instructions on operating and maintaining the RURK I. ***Upon completion of the above-mentioned CD-ROM, see your Unit Education and Training Manager to take the following mandatory CerTests. Trainee must score at least 80% to meet the minimum completion requirement for diamond tasks.***

Test #	Title
8033	POL RURK I AFQTP, Test One
8034	POL RURK I AFQTP, Test Two
8035	POL RURK I AFQTP, Test Three
8036	POL RURK I AFQTP, Test Four

NOTE:
The review questions for this material are in the above-mentioned CD-ROM.

3. If equipment is available, then perform the following for hands-on certification training.

3.1. Setting Up RURK for Inspecting, Servicing, and Operational Checks.

3.1.1. Procedures For Setting Up RURK.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.1.

Step 2: Review POL RURK historical records and check results of previous inspection, if any.

Step 3: Select site for inspection and service.

NOTE:
Inspection site should be a covered warehouse or maintenance facility.

Step 4: Obtain common and bulk items required to inspect and service POL RURK as follows:

NOTE:
Acquire common and bulk items from LFM shop or any other source rather than consume and deplete the POL RURK supplies.

4.1. Twelve cleaning rags.
4.2. Two containers of environmentally safe cleaning solvent.
4.3. Two wire brushes.
4.4. One can of lubricating oil, 10W non-detergent, or suitable substitute.
4.5. One roll 0.032 inch safety wire.
4.6. One can air motor oil.
4.7. One grease gun with soft grease.
4.8. Twelve D-cell flashlight batteries.
4.9. One generator battery.
4.10. Automatic gas alarm battery.
4.11. Utility line tracer batteries.
4.12. Two sheets metal sandpaper.
4.13. One can gray primer spray paint.
4.14. One can olive green spray paint.
4.15. One 5-ton automotive jack.
4.16. One can bearing grease.
4.17. One common toolbox.

Step 5: Obtain a tow vehicle capable of moving the trailer and compressor.

Step 6: Move trailer and compressor to work area.

6.1. Set trailer-parking brake and unhook tow vehicle.

3.1.2. Procedures for Inspecting/Operationally Checks on Trailer (Figure 7).

Figure 7. RURK Trailer

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.2.

Step 2: Inspect frame and exterior surface for rust and corrosion.

2.1. Clean and sand metal surfaces to remove rust or corrosion.

Step 3: Using gray primer spray, coat repaired surface and lightly sand.

Step 4: Using olive green spray paint, coat primed surface.

Step 5: Inspect tires for cuts and deterioration and test for proper pressure.

5.1. Replace cut or deteriorated tires.

5.2. Inflate tires to rated pressure.

Step 6: Using grease gun with soft grease, grease all trailer grease fittings.

Step 7: Using 5-ton automotive jack, raise and pull each wheel.

7.1. Check wheel bearings and brake linings for wear.

7.2. Replace, if necessary.

Step 8: Repack wheel bearings and replace wheel on trailer.

Step 9: Inspect and test parking brake by setting brake and attempting to move trailer.

9.1. Parking brake is serviceable if tires remain locked.

Step 10. Raise automatic brake mechanism to the upright position and attempt to move trailer forward.

10.1. Automatic brake mechanism is serviceable if tires remain locked.

Step 11: Release automatic brake mechanism by pushing the lever to the down position.

Step 12: Inspect wiring and electrical connectors for fraying, deterioration, and/or corrosion.

12.1. Repair as necessary.

Step 13: Using power from the prime mover vehicle, check all brake, turn signal, and running lights for proper operation.

13.1. Replace bulbs and/or repair as necessary.

Step 14: Inspect door latches and hinges.

14.1. Lightly oil as necessary.

Step 15: Inspect tongue and safety chain for proper operation and swivel.

15.1. Lubricate or grease as necessary.

SAFETY:

THE TRAILER IS EQUIPPED WITH A BRAKE DISABLING PIN. THIS PIN SHOULD BE PULLED BEFORE THE TRAILER IS TOWED FORWARD OVER-THE-ROAD. LEAVE PIN IN STALLED FOR OFF-ROAD OPERATIONS. FAILURE TO FOLLOW THIS PROCEDURE MAY RESULT IN EQUIPMENT DAMAGE AND/OR LOSS OF LIFE.

Step 16: Set parking brake and install the ramps.

3.1.3. Procedures for Inspecting and Servicing Compressor.

Figure 8. Compressor Control Panel

Step 1: Locate T.O. 34Y1-258-1, Compressor, Rotary, Diesel Engine.

1.1. Refer to paragraph 3-4.

Step 2: Visually inspect compressor for external damage and security of components.

SAFETY:

1. OPERATE COMPRESSOR IN AREA WITH ADEQUATE VENTILATION. INHALATION OF TOXIC EXHAUST COULD RESULT IN SERIOUS INJURY OR DEATH.

2. IF USING THE ETHER CANISTER FOR COLD WINTER STARTS, ENSURE PERSONNEL STAY CLEAR OF THE ETHER CANISTER. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY.

Step 3: Check fuel and oil levels. Add fuel or oil as needed to fill.

Step 4: Inspect all hoses for kinks, wear, and damage to pins. Repair or replace as required.

Step 5: Operationally check the compressor in accordance with (IAW) instructions on the control panel.

NOTE:
If compressor inspection is unsuccessful and problem cannot be cleared, turn in compressor for maintenance and obtain a replacement.

Step 6: If necessary, repeat steps (1) through (5) on the replacement compressor.

Step 7: Shut down compressor IAW instructions on the control panel.

3.1.4. Procedures for Inspecting and Servicing Generator (Figure 9).

Figure 9. Generator

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.4.

Step 2: Unpack/remove generator from Container #2.

SAFETY:
TWO HUNDRED POUND WEIGHT OF GENERATOR EXCEEDS THE SAFE LIFT CAPACITY OF TWO PEOPLE. GENERATOR SHOULD BE LIFTED BY NO FEWER THAN THREE PEOPLE OR SERIOUS PERSONNEL INJURY COULD RESULT.

Step 3: Carry generator from trailer and down the ramps.

Step 4: Position generator by carrying to a ventilated area.

Step 5: Remove preserve, set up, and inspect generator IAW T.O. 35C2-3-499-1, Chapter 3, Section 1, paragraph 3-2 and 3-3.

Step 6: Install generator battery IAW T.O. 35C2-3-499-1, Chapter 3, Section I, Paragraph 3-3d.

Step 7: Connect generator ground wire to a local ground, if available, or install a ground rod.

Step 8: Operationally test generator IAW T.O. 35C2-3-499-1, Chapter 4, Section II, paragraphs 4-2 through 4-8.

NOTE:

1. This step must be accomplished with the assistance of a certified power production technician.
2. If generator inspection is unsuccessful and problem cannot be cleared, turn in generator for maintenance and obtain a replacement.

Step 9: If necessary, repeat steps 4 through 8 on replacement generator.

Step10: Turn off generator.

NOTE:

If lights need to be checked at this time, leave the generator operating.

Step 11: Repackage generator for extended storage, using saved packing materials, IAW T. O. 35C2-3-499-1, Chapter 3, Section II, paragraph 3-4.

3.1.5. Procedures for Inspecting and Operationally Check for Essential Tool Set (Figure 10).

Figure 10. Essential Tool Kit

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.5.

Step 2: Obtain essential tool set and unpack.

Step 3: Conduct a complete inventory using T.O. 35D26-9-2-1, Chapter 6 as a guide.

Step 4: Inspect each tool for serviceability and corrosion.

Step 5: Clean, lightly oil, and wipe each tool, as required.

Step 6: Install flashlight batteries in flashlights and check serviceability.

Step 7: Remove batteries and repack flashlights in tool set.

3.1.6. Procedures for Inspecting and Operationally Check for Automatic Gas Alarm (Figure 11).

Figure 11. Automatic Gas Alarm

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.6.

Step 2: Unpack automatic gas alarm from trailer and visually inspect packaging.

Step 3: Unpack and inventory the following components:

3.1. Meter.

3.2. Calibration kit.

3.3. 2 oxygen sensors (in sealed package).

3.3.1. DO NOT open sealed packages until components are required.

3.4. Charging cord.

3.5. Sampling hose.

3.6. Manufacturer's catalog.

Step 4: Have PMEL service and calibrate the gas alarm IAW T.O. 11H5-35-1, Alarm System, Combustible Gas, and Oxygen Indicator, Automatic.

Step 5: Operationally test all alarm functions, i.e. lower explosive limit (LEL) % and O_2 for proper operation. Return alarm to PMEL if repairs are required.

Step 6: Remove battery.

Step 7: Repackage and place in storage.

3.1.7. Procedures for Inspecting and Operationally Check for Utility Line Tracer (Figure 12).

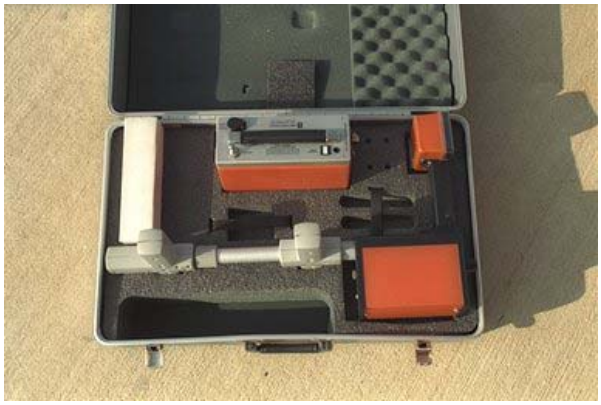

Figure 12. Utility Line Tracer

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.7.

Step 2: Obtain utility line tracer from trailer and visually inspect packaging.

Step 3: If packaging is not intact, install battery, set-up, inspect, operationally check, and calibrate IAW manufacturer's documentation provided with the unit.

Step 4: Remove battery.

Step 5: Repackage and place in storage.

3.1.8. Procedures for Inspecting and Operationally Check for Portable Floodlights (Figure 13).

Figure 13. Portable Floodlight

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.8.

Step 2: Remove ground fault interrupters (GFIs) from trailer and connect to generator.

Step 3: Obtain portable floodlights from trailer and unpack.

Step 4: Inspect floodlights for obvious damage and /or deterioration.

Step 5: Start generator.

SAFETY:
DO NOT CONNECT POWER CABLE EXTENSIONS TO GFIs OR GENERATOR OUTLETS UNTIL GENERATOR IS RUNNING OR DAMAGE TO GENERATOR COULD RESULT.

Step 6: Plug in portable floodlights to an outlet on GFI and check for proper operation.

SAFETY:
ENSURE THE LENS GASKET/SEAL IS INSTALL PROPERLY. FLOODLIGHT COULD LOSE EXPLOSION PROOF PROPERTIES AND SERIOUS INJURY OR DEATH TO PERSONNEL COULD RESULT.

Step 7: If inoperable, replace lamp using the following procedures:

7.1. Remove lens retaining ring.

7.2. Remove lens and gasket/seal.

7.2.1. Examine gasket/seal for signs of damage or deterioration.

7.2.2. Replace gasket/seal (if necessary).

7.3. Unscrew and dispose of lamp.

7.3.1. Install replacement lamp.

7.4. Install gasket/seal.

7.5. Install lens retaining ring.

Step 8: If still inoperable, turn in for repair or replacement.

Step 9: Repeat procedure on replacement floodlight.

Step 10: Repackage and return operable floodlight to storage.

3.1.9. Procedures for Inspecting and Operationally Check for Mast Floodlights (Figure 14).

Figure 14. Mast Floodlights

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.9.

Step 2: Obtain area floodlights from trailer and unpack.

Step 3: Inspect floodlights for obvious damage and /or deterioration.

SAFETY:
DO NOT CONNECT POWER CABLE EXTENSIONS TO GFIs OR GENERATOR OUTLETS UNTIL GENERATOR IS RUNNING OR DAMAGE TO GENERATOR COULD RESULT.

Step 4: Plug in area floodlights to an outlet on GFI and check for proper operation.

Step 5: If inoperable, replace lamp IAW T.O. 35F5-5-16-1, TF-1 Lighting Assembly.

Step 6: If still inoperable, turn in for replacement.

Step 7: Repeat procedure on replacement floodlight.

Step 8: Repackage and return operable floodlight to storage.

3.1.10. Procedures for Inspecting and Operationally Check for Deicer Assembly (Figure 15).

Figure 15. Deicer Assembly

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 5-2.15.

Step 2: Obtain deicer assembly from trailer and inspect packaging.

Step 3: Service deicer assembly IAW Tanner Systems, Inc. Deicer Model T-83 commercial manual.

SAFETY:
DO NOT SUPPORT THE DEICER BY HOSES ALONE. THE WEIGHT AND MOVEMENT OF THE DEICER COULD CAUSE DAMAGE OR CRACKING TO THE BODY. AIR SHOULD FLOW THROUGH THE DEICER IN THE DIRECTION INDICATED.

3.1. Visually inspect the canister for cracks.

3.2. Remove the reservoir fill cap.

3.3. Fill with deicer fluid to recommended level.

3.4. Replace fill cap.

3.5. Drain moisture from moisture trap.

3.6. Close moisture trap petcock.

Step 4: Inspect and operate the deicer IAW Tanner Systems, Inc., Deicer Model T-83 commercial manual.

SAFETY:
ENSURE ALL AIR SUPPLY VALVES ARE CLOSED.

4.1. Connect the air hoses to the deicer. Ensure airflow will be in the direction of the arrows on the deicer.

SAFETY:
FAILURE TO SAFETY WIRE CONNECTIONS COULD RESULT IN PERSONNEL INJURY OR EQUIPMENT DAMAGE.

4.2. Safe all connections with safety wire or safety clip.

4.3. Start the compressor and slowly open the compressor airline supply valve.

4.4. Slowly open deicer supply valve and ensure air is flowing through the deicer in the direction indicated.

Step 5: Turn off compressor and close all air valves.

Step 6: Return deicer assembly to storage container.

3.2. Preparing Worksite and Setting Up Equipment for an In-Crater Repair.

3.2.1. Procedures for Assess Pipeline Damage.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.3.

Step 2: If possible, approach site from upwind and uphill, stopping no closer than 50 feet from crater.

SAFETY:
NO ONE SHALL ENTER WORK SITE AREA UNTIL DIRECTED BY TEAM CHIEF. SAFETY HAZARDS SUCH AS UXO AND EXPLOSIVE FUEL VAPOR MAY EXIST. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

Step 3: Using the automatic gas alarm, (IAW T.O. 11H-35-1) approach, and circle the crater on foot.

Step 4: Lower automatic gas alarm sampling hose end to bottom of crater.

SAFETY:

PERSONNEL SHOULD NOT ENTER CRATER AND MUST EXIT, IF WORKING IN CRATER, WHEN THE LOWER EXPLOSIVE LIMIT (LEL) IS ABOVE 1%. AN LEL GREATER THAN 1% REPRESENTS A BREATHING HAZARD. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

Step 5: If LEL exceeds 1 %, start ventilation with vaneaxial fan using procedures in T. O. 35D26-9-2-1, paragraph 4-4.4.10.

5.1. Enter crater when LEL is less than 1%.

Step 6: Assess pipeline damage and confirm type of repair (in-crater, bypass, valve pit, end cap, or puncture) necessary.

Step 7: Determine crater preparation requirement.

Step 8: Advise Damage Control Center (DCC) and await instructions.

3.2.2. Procedures for Determining Work Site Preparation Requirements.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.1.

Step 2: Determine crater entry/exit, trailer, and compressor locations.

Step 3: Determine need to pump out crater.

Step 4: If necessary to pump out crater, contact DCC for direction whether to discharge liquid on ground, in a holding pit or collapsible fabric tank.

Step 5: Determine crater preparation requirements for backhoe.

3.2.3. Procedures for Positioning Trailer and Compressor.

SAFETY:

1. EQUIPMENT AND TOOLS MUST BE POSITIONED TO ALLOW UNIMPEDED CRATER ACCESS/EGRESS IN AN EMERGENCY. FAILURE TO DO SO COULD RESULT IN SERIOUS PERSONNEL INJURY.

2. DO NOT ATTEMPT TO BACK UP VEHICLES WITH COMPRESSOR UNIT ATTACHED. EQUIPMENT MAY BE DAMAGED AND SERIOUS PERSONNEL INJURY COULD RESULT.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.2.

Step 2: Position the fire extinguisher near access/egress route.

NOTE:

If practical, compressor and generator should be positioned at least 50 feet from and on the upwind side of the crater. This reduces the potential of exhaust sparks blowing into the crater or fuel vapor entering unshielded engine compartments.

Step 3: Disconnect compressor from tow vehicle and place at least 50 feet from and upwind of the crater.

Step 4: Position trailer sufficient distance from compressor to setup trailer ramps and allow unimpeded access.

3.2.4. Procedures for Setting Up Generator.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.3.

NOTE:
Determine if generator is required. If required proceed with the following steps.

Step 2: Carry the generator from the trailer and down the ramps.

SAFETY:
TWO HUNDRED POUND WEIGHT OF GENERATOR EXCEEDS SAFE LIFT CAPABILITY FOR TWO PEOPLE. GENERATOR SHOULD BE LIFTED BY NO FEWER THAN THREE PEOPLE OR SERIOUS PERSONNEL INJURY COULD RESULT.

Step 3: Position the generator by carrying it to a location at least 50 feet from and upwind of the crater.

Step 4: Set up the generator IAW T.O. 35C2-3-499-1.

Step 5: Assemble and install ground rod and hook up to generator as follows:

5.1. Using both ends of the slide hammer, repeatedly strike ground rod until first section is driven into the ground.

5.2. Remove hammer and thread on another section of ground rod. Use hammer as before and pound in sections until ground rod depth is eight feet plus one foot exposed or until the ground rod refuses to go farther.

5.3. Connect a grounding cable from generator to exposed ground rod.

3.2.5. Procedures for Setting Up Portable Floodlights (if required for night operating).

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.4.

SAFETY:
1. NEVER MAKE POWER CABLE EXTENSION CONNECTIONS IN THE CRATER. FUEL VAPORS COULD BE PRESENT AND AN EXPLOSION AND/OR FIRE COULD RESULT AND CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.
2. DO NOT CONNECT POWER CABLE EXTENSIONS TO GROUND FAULT CIRCUIT INTERRUPTERS (GFCIs) OR GENERATOR OUTLETS UNTIL GENERATOR IS RUNNING OR DAMAGE TO GENERATOR COULD RESULT.

NOTE:
Explosion proof flashlights from the essential tool set can be used for illumination while setting up work site lighting.

Step 2: Start generator set.

Step 3: Remove portable floodlights, power cable extensions, and GFCIs from the trailer.

Step 4: Connect GFCIs to generator receptacles.

Step 5: Connect portable floodlights to GFCI.

5.1. Position floodlights as necessary.

NOTE:
Portable floodlights are explosion proof and may be taken into the crater.

3.2.6. Procedures For Setting Up Mast Floodlights (if required for night operating).

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.5.

SAFETY:
MAST FLOODLIGHTS SHOULD BE POSITIONED A MINIMUM OF 15 FEET FROM THE EDGE OF THE CRATER. FUEL VAPORS COULD EXPLODE IF AN OPERATING LAMP FALLS INTO CRATER, RESULTING IN DEATH OR SERIOUS INJURY TO PERSONNEL.

Step 2: Remove mast floodlights and power cable extensions from trailer.

Step 3: Place mast floodlights in position around crater to illuminate as much of work site as possible.

Step 4: Connect mast floodlights to GFCIs.

Step 5: Adjust mast floodlights as needed.

3.2.7. Procedures for Setting Up Compressor.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.6.

Step 2: Set up the compressor IAW T.O. 34Y1-184-21.

Step 3: Remove airline manifold and deicing assembly from trailer and position at crater edge.

Step 4: Install ground rod and connect air manifold ground wire to ground rod.

4.1. Refer to this AFQTP Generator Setting Up procedures, paragraph 3.2.4., step 5.

Step 5: Attach two compressor airlines to deicing assembly and safety wire or pin couplings.

Step 6: Attach two deicing outlet airlines to airline manifold and safety wire or pin couplings.

Step 7: Close airline manifold valves.

Step 8: Start compressor and confirm air pressure.

Step 9: Open two hose/reel airline valves and two air manifold valves.

3.2.8. Procedures for Setting Up Diaphragm Pump (Figure 16) (if required).

Figure 16. Diaphragm Pump

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.7.

Step 2: Remove reciprocating pump, suction and discharge hose assemblies, and suction strainer from trailer.

NOTE:
Use of reciprocating pump is necessary when crater contains standing liquids that will interfere with repair procedures.

Step 3: Attach suction strainer to suction hose.

3.1. Safety wire or pin suction hose couplings.

NOTE:
DO NOT use reciprocating pump-to-pump liquid from the crater without a strainer attached to the suction hose. Failure to use a strainer will allow debris to clog the pump.

Step 4: Remove inlet cap from reciprocating pump and attach suction hose to pump inlet.

4.1. Safety wire or pin suction hose couplings.

Step 5: Position suction strainer as deep in liquid as possible.

5.1. Remove outlet cap from reciprocating pump and attach discharge hose.

5.2. Safety wire or pin suction hose couplings.

SAFETY:

1. DO NOT ALLOW NBC PROTECTIVE CLOTHING AND EQUIPMENT TO COME IN CONTACT WITH LIQUID OR SATURATED SOIL. CONTACT WILL RENDER CLOTHING INEFFECTIVE AND SERIOUS PERSONNEL INJURY OR DEATH COULD RESULT.

2. AVOID SKIN OR CLOTHING CONTACT WITH FUEL OR FUEL SATURATED SOIL. PROLONGED CONTACT COULD RESULT IN PERSONNEL INJURY.

Step 6: Route discharge hose to downhill side of crater (if draining on ground), in holding pit, or collapsible fabric tank.

6.1. Safety wire or pin suction hose couplings.

Step 7: If necessary, obtain collapsible fabric tank and place within reach of discharge hose.

7.1. Safety wire or pin suction hose couplings.

Step 8: Set up collapsible fabric tank.

8.1. Hook up discharge hose from reciprocating pump.

8.2. Safety wire or pin suction hose couplings.

NOTE:

1. Save filler cap from collapsible fabric tank for use when tank is filled.
2. Fabric tank should be marked as CONTAMINATED.

Step 9: Remove airline from trailer and attach between reciprocating pump and airline manifold.

SAFETY:

RECIPROCATING PUMP MUST BE IN THE OFF POSITION BEFORE ATTACHING AIRLINE. SUCTION AT INLET COULD CAUSE PERSONNEL INJURY.

Step 10: Remove airline from trailer and attach between diaphragm pump and airline manifold.

Step 11: Turn on airline manifold control valves to pump.

Step 12: Turn on diaphragm pump air valve.

Step 13: Position suction strainer to drain as much liquid from crater as possible.

NOTE:

The backhoe or a shovel can be used to dig a sump trench. Placing the suction strainer in the trench will remove most of the liquid.

Step 14: Shut off diaphragm pump when no longer needed or when convenient.

3.2.9. Procedures for Crater Preparation.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.9.

Step 2: Using backhoe, remove any liquid-saturated soil from bottom of crater, as required, and place on downhill side of crater and downwind, if possible.

SAFETY:

USE EXTREME CARE WHEN USING BACKHOE OR EQUIPMENT IN CRATER AROUND DAMAGED PIPELINE. STRIKING THE PIPE CAN CAUSE SPARKS, WHICH COULD CAUSE A FIRE OR EXPLOSION.

Step 3: Using backhoe, expose at least three feet of undamaged and visibly round pipe on each side of damaged pipe section.

NOTE:

If feasible, and as an option to removing saturated soil, use the backhoe to backfill crater with unsaturated soil to create a vapor barrier.

Step 4: Using backhoe and/or hand tools, prepare a level working area by placing and leveling uncontaminated soil two to three feet between pipeline and crater floor.

NOTE:

Failure to expose at least three feet of undamaged and visibly round pipe will require additional excavation and will greatly increase repair time.

Step 5: Using backhoe, create a access and exit ramp to facilitate repair or provide a quick egress in an emergency situation.

3.2.10. Procedures for Setting Up Vaneaxial Fan.

Figure __, Vaneaxial Fan

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.10.

Step 2: Remove vaneaxial fan and exhaust ducts from trailer.

NOTE:
Always set up vaneaxial fan if LEL is greater than 1%.

Step 3: Position vaneaxial fan on downwind side of crater edge.

Step 4: Turn off fan air valve.

Step 5: Direct fan outlet away from crater.

Step 6: Using a hex-head nut driver from essential tool set, first attach exhaust ducts together and then to fan.

Step 7: Position duct inlet at bottom of crater, avoiding liquid and keeping clear of work area.

Step 8: Remove airline from trailer and connect between fan and airline manifold.

Step 9: Turn on vaneaxial fan air valve.

SAFETY:
DO NOT STAND DOWNWIND OF AN OPERATING FAN. TOXIC FUEL VAPORS COULD CAUSE SERIOUS INJURY TO PERSONNEL.

3.2.11. Procedures for Tools and Equipment Setup.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.4.11.

Step 2: Remove essential tool set, power hacksaw, and coating removal tool from trailer and position near crater entry point.

SAFETY:
1. TOOLS AND EQUIPMENT SHOULD BE POSITIONED TO ALLOW UNIMPEDED EGRESS FROM CRATER. DELAY IN LEAVING CRATER IN AN EMERGENCY COULD CAUSE INJURY TO PERSONNEL.

2. WHEN LAYING DOWN THE POWER HACKSAW, THE AIR VALVE SHOULD BE FACING UP. FAILURE TO DO SO COULD DAMAGE SAW.

Step 3: Remove required support tools from trailer and position at crater entry point.

Step 4: Install a blade in the power hacksaw and raise the blade to the full up position.

Step 5: Determine repair components required. Refer to T.O. 35D26-9-2-1, Table 4-1.

Step 6: Remove required repair components from trailer and place whatever possible in component Schafer boxes.

Step 7: Place Schafer boxes and all other repair components at crater entry point or in the crater if possible.

3.3. Procedures for In-Crater Repair.

3.3.1. The following procedures cover 1-inch through 12-inch fuel pipelines. The procedures for each diameter are similar. Complete repair procedures are provided for 4-inch diameter pipeline. For 6-, 8-, 10-, and 12-inch pipeline repair, reference is made only to those procedures that differ from the 4-inch procedures. The in-crater repair team is comprised of three team members. To minimize repair time, steps in the following repair procedures can be performed simultaneously.

SAFETY:

1. NO ONE SHALL ENTER THE WORK SITE UNTIL DIRECTED BY THE TEAM CHIEF. SAFETY HAZARDS SUCH AS UXO AND EXPLOSIVE FUEL VAPORS MAY EXIST. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

2. DO NOT ALLOW NBC PROTECTIVE CLOTHING AND EQUIPMENT TO COME IN CONTACT WITH FUEL OR FUEL-SATURATED SOIL. CONTACT WILL RENDER CLOTHING INEFFECTIVE AND SERIOUS PERSONNEL INJURY OR DEATH COULD RESULT.

3. WIRES, AIRLINES, AND HOSES PRESENT TRIPPING HAZARDS. FAILURE TO EXERCISE CAUTION COULD CAUSE SERIOUS INJURY TO PERSONNEL.

4. CONTINUALLY MONITOR LEL UNTIL REPAIR IS COMPLETE. TOXIC FUEL VAPORS COULD CAUSE SERIOUS INJURY TO PERSONNEL.

NOTE:

1. If NBC protective clothing is required, tasks may require additional time, assistance, and safety emphasis due to reduced visibility and bulk of the CW ensemble.

2. Two-foot by four-foot plywood sections are available for placement in crater bottom to protect NBC clothing from fuel contamination or for use as work aids.

3. Torque wrenches should always be reset to their lowest setting after use.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-5.2.

Step 2: Position automatic gas alarm sampling hose end at lowest point in the crater.

2.1. Set to ALARM position.

Step 3: If LEL goes above 1% or alarm sounds, evacuate crater.

3.1. Reenter crater when LEL is 1% or below.

Step 4: Use picks and hand shovels to expose and clear entire circumference of at least three feet of good pipeline.

Step 5: Visually inspect pipeline.

5.1. Select and mark cut locations on both sides of damaged pipeline.

5.2. Locate cuts on pipeline that appears to be round and straight.

Step 6: Place essential tool set and component Schafer boxes in crater or on crater edge as working space allows.

Step 7: Measure distance between selected cut locations using measuring tape from the essential tool set.

NOTE:
There should be at least 15 feet between pipe cuts for two hard wall hoses. A portion of the hard wall hose should rest on the ground to relieve stress exerted on the axial thrust coupling.

Step 8: Locate an area on top of each end of the pipeline, close to the crater wall, but a minimum of $1^{1}/_{2}$-feet from the pipeline area to be cut, where ground clamp assemblies can be attached.

Step 9: Install ground clamp assemblies as follows:

9.1. Using a coarse file, remove a minimum ¼-inch diameter area of pipe coating from the top of the pipeline.

9.2. Expose enough clean metal on surface of pipeline to make a good electrical connection with the grounding clamp assembly.

9.3. Position grounding clamp assembly over cleaned area of pipeline.

9.4. Pull webbing around pipeline until webbing is snug.

9.5. Attach webbing hook to webbing latch bracket.

9.6. Ratchet webbing buckle and secure firmly to pipeline.

9.7. Rotate grounding screw until it makes solid contact with exposed metal surface on pipeline.

NOTE:
When connecting pipeline with grounding screw, do not over-tighten screw or damage to grounding screw could result and invalidate grounding.

Step 10: Route 50-foot grounding wire attached to grounding clamp assembly out of crater, keeping wire in a low-traffic area.

Step 11: Connect ground clamp assembly ground wires and air manifold ground wire to the ground rod.

Step 12: If necessary, drain pipeline of fuel using tapping and fuel suction equipment.

Step 13: Cut pipeline using power hacksaw as follows:

13.1. Remove power hacksaw from crater edge. (If power hacksaw is unusable, use manual pipe cutter (step 13.21.) or bow saw (step 13.22.) to cut pipeline.)

SAFETY:
WEIGHT OF POWER HACKSAW EXCEEDS ONE-PERSON SAFE LIFTING CAPABILITY. PERSONAL INJURY COULD RESULT IF LIFTED BY ONLY ONE PERSON.

13.2. Recheck saw blade position to ensure it is in the highest position.

SAFETY:

1. THE PORTABLE HACKSAW CUTTING BLADE SHOULD BE POSITIONED WITH THE BLADE SIDE OF SAW FACING DAMAGED END OF PIPELINE OR SAW WILL FALL AT END OF CUT AND SERIOUS PERSONNEL INJURY COULD RESULT.

2. NEVER ATTEMPT TO RETIGHTEN WHEN THE SAW IS IN OPERATION. SERIOUS PERSONAL INJURY OR EQUIPMENT DAMAGE MAY RESULT.

13.3. Position the saw on the pipeline, aligning the saw blade over the cut position. Hold the saw securely in place, wrap chain around pipeline, and secure chain to the saw fixture. Tighten chain tension nut with attached wrench until saw is solidly attached to the pipeline. During the saw cut, check and retighten as required. (The third person should remove the saw blade coolant from the component Schafer box and bring into the crater.)

13.4. Ensure saw blade teeth point away from the saw blade tension knob. Ensure knob is tight.

SAFETY:

AIR VALVE ON POWER HACKSAW SHOULD BE IN THE CLOSED POSITION BEFORE ATTACHING AIR LINE OR SAW WILL ACTIVATE PREMATURELY AND SERIOUS INJURY TO PERSONNEL COULD RESULT.

13.5. Close power hacksaw air valve.

SAFETY:

KEEP HANDS AND CLOTHING CLEAR OF SAW BLADE MOVEMENT OR HAND/CLOTHING COULD BE CAUGHT IN MECHANISM AND CAUSE SERIOUS PERSONNEL INJURY.

13.6. If required to prevent binding, obtain V-head pipe stands and pipe stand base and place under pipeline section being cut.

13.7. Attach airline-to-airline manifold and saw.

SAFETY:

OPERATE POWER HACKSAW AND APPLY COOLANT FROM MOTOR SIDE OF SAW CUT OR INJURY TO OPERATOR COULD RESULT.

13.8. Liberally apply saw blade coolant to saw blade before and during the cutting process.

NOTE:

1. If the air motor fails to rotate when air is applied, immediately close the saw air supply valve. The air motor shaft should be manually rotated to ensure the shaft turns freely. Saw lubrication should also be checked.

2. At this point, the two team members not involved in the cut will remove two hard wall hoses and a minimum of three clamps from the trailer and position them at the crater's edge.

13.9. Start cut by slowly opening the saw air valve.

13.10. Turn feed handle clockwise to engage saw blade with pipe.

13.11. Continue to rotate feed handle, applying sufficient force to cause rapid cutting but not enough to bind saw blade or slow cutting action.

13.12. If saw blade stops, retract blade by rotating feed handle counterclockwise until saw blade is free and saw action continues.

SAFETY:

STAND CLEAR OF PIPELINE AS IT DETACHES AFTER CUT COMPLETION. IT WILL FALL AND COULD CAUSE PERSONNEL INJURY.

13.13. Continue cutting operation until pipeline is completely cut.

13.14. Close air valve on saw when cut is complete.

SAFETY:

AIRLINE TO POWER HACKSAW SHOULD BE DISCONNECTED BEFORE RELOCATING SAW. INADVERTENTLY STARTING SAW MOTOR COULD CAUSE SERIOUS INJURY TO PERSONNEL.

13.15. Disconnect airline.

13.16. Rotate feed handle counterclockwise and move saw blade to full **UP** position.

13.17. Check the pipeline end for roundness. This is done by measuring the minimum and maximum outside diameters of pipeline end using measuring tape from the essential tool set.

13.18. If pipe cut is not round, reposition saw and re-cut using above procedure.

13.19. Make second cut on opposite pipe using the same procedures.

SAFETY:

WHEN LAYING THE PORTABLE HACKSAW DOWN, THE AIR INLET SHOULD BE FACING UP, OR THE SAW MAY BE DAMAGED.

13.20. After achieving a round cut, remove the saw from the pipeline.

13.21. Cut damaged pipeline using pipe cutters as follows:

13.21.1. Remove manual pipe cutter from trailer.

NOTE:

The small manual pipe cutter is used to cut 4-inch pipe. The large pipe cutter is used to cut 6-inch through 12-inch pipe.

13.21.2. Open jaws of pipe cutter and adjust to fit over pipeline. Position cutting wheel over cut location.

13.21.3. Obtain adjustable pipe stands and pipe stand bases and place under section of pipeline to be cut.

NOTE:
Area where pipe strand bases are to be placed may require leveling to provide firm footing.

13.21.4. Adjust pipe stands as required to prevent cutter from binding and pipe from sagging or falling.

SAFETY:
PIPELINE WILL DETACH SUDDENLY AND WITHOUT WARNING AT COMPLETION OF CUT. STAND CLEAR OF PIPELINE OR SERIOUS PERSONNEL INJURY COULD RESULT.

13.21.5. Liberally apply coolant to saturate pipeline and cutting wheels before and during cutting process.

13.21.6. Rotate manual pipe cutter approximately 180^{O} back and forth around pipeline while advancing cutting feed screw. Continue until pipeline is cut.

13.22. Cut damage pipeline using a bow saw as follows:

13.22.1. Remove bow saw from trailer.

13.22.2. Remove adjustable pipe stands and pipe stand bases and place under section of pipeline to be cut out.

NOTE:
1. Area where pipe bases are placed may require leveling to provide firm footing.

2. Bow saw can be used to complete cuts begun by other methods and/or to cut pipes not supported on the ends.

13.22.3. Liberally apply coolant to cut area.

13.22.4. Align saw blade perpendicular to pipe axis at top of cut location.

13.22.5. Begin cut using a continuous reciprocating motion, making cut as square as possible.

13.22.6. Continue to cut and apply coolant until pipe is cut.

13.22.7. Visually check squareness of cut by placing axial thrust coupling around pipeline.

13.22.8. If more than ½-inch out-of-square, re-cut.

Step 14: Remove damaged pipeline section from crater only if it interferes with repair work.

14.1. If damaged section of pipeline is too heavy to move by hand, use wrecking bars, hand winch with strap, or backhoe to move pipeline sections.

Step 15: Remove pipeline coating from pipeline ends as follows:

NOTE:
If pipe has no coating, pipe still requires de-burring and cleaning, steps (15.11.) and (15.12.).

15.1. Obtain coating removal tool. If coating removal tool is ineffective, pipeline coating may be removed using available hand tools such as file, knife, scraper, etc.

15.2. If necessary, adjust coating removal tool cutting head adapter for diameter of pipeline being cut.

15.2.1. Remove quick release pin.

15.2.2. Position cutting head adapter to the correct position on the tool carrier.

15.2.3. Insert quick-release pin.

15.3. Lock cutting head into UP position.

15.4. If required, adjust tool to remove a minimum of three inches of pipeline coating.

15.5. With feed handle pointed down, insert expansion arms of tool into pipeline ends until tool hits cutting stop.

15.6. Secure tool in place by turning the tightening handle clockwise until expansion arms expand and firmly grip the interior pipeline surface.

15.7. Unlock cutting head and allow tool bit to just barely contact the coating surface.

SAFETY:

DO NOT FORCE THE BLADE ONTO THE PIPE, OR DAMAGE TO THE BLADE AND PIPE COULD RESULT.

NOTE:

Proper coating removal results in a smooth, round pipe surface with a majority of pipeline coating removed. A thin film remaining on the pipeline is acceptable.

15.8. Using feed handle, rotate tool counter-clockwise until coating is removed. Place pressure on load handle if cutting tool fails to remove coating uniformly.

15.9. Lock cutting head in UP position. Rotate feed handle clockwise to beginning position in preparation for next cut.

15.10. Remove tool from pipeline by turning the tightening handle counterclockwise until the expansion arms are loose.

15.11. Using a hand file, remove outside diameter burrs from pipeline ends.

15.12. Use leather gloves to clean and remove pipeline saw blade coolant, metal filings, coating remnants, and other debris from inside and outside the pipeline.

15.13. Insert reinforcement sleeves into 10- and 12-inch schedule 10 pipe. Torque reinforcement sleeves to ½ the torque value shown on the axial thrust coupling to be installed.

Step 16: Install pipe adapter and axial thrust coupling on pipeline end as follows:

16.1. Retrieve axial thrust coupling and pipe adapter from component Schafer box at the crater's edge. Remove ratchet and hex bit socket and torque wrench from essential tool set.

16.2. Loosen hex heads on axial thrust coupling and slide onto pipe until it stops. Do not force the thrust coupling.

16.3. Insert the pipe adapter into axial thrust coupling until coupling makes contact with adapter stops.

16.4. Holding coupling and adapter together by hand, install onto pipe end.

NOTE:
The end of the adapter must make contact with the face of the pipeline end and the coupling must remain in contact with the adapter stop when being attached to the pipeline. This action positions the coupling half over the pipeline and half over the pipe adapter.

16.5. Position coupling so bolt hex heads are facing up.

NOTE:
Use the $^{3}/_{8}$-inch drive ratchet and 8-mm hex bit socket for 4-inch pipe. The ½-inch drive ratchet and 17-mm hex bit socket are used for 6- through 12-inch pipe.

16.6. Alternately tighten each bolt until snug.

SAFETY:
1. OVER-TORQUING AXIAL THRUST COUPLING COULD CAUSE COUPLING FAILURE, RESULTING IN CATASTROPHIC FAILURE AT THE REPAIR CONNECTION. SERIOUS INJURY OR DEATH TO PERSONNEL COULD RESULT.

2. TWO PEOPLE MAY BE REQUIRED TO TORQUE THE AXIAL THRUST COUPLING; DEPENDING ON THE TORQUE VALUE REQUIRED.

16.7. Alternately turn each bolt until torqued to ± 10% of the value indicated. Repeat until each bolt torques within ¼ turn.

NOTE:
Torque wrenches should always be reset to their lowest setting after use.

16.8. Repeat procedure for other pipeline end.

Step 17: Assemble pipeline repair section as follows:

SAFETY:
END-GROVES SHOULD BE ALIGNED WITH THE SNAP CLAMP BEFORE ACTUATING CLAMP LEVER OR DAMAGE TO THE SNAP CLAMP GASKET COULD RESULT. ALWAYS CONNECT HARD WALL HOSE TO PIPE ADAPTERS. NEVER DIRECTLY CONNECT A RIGID PIPE SECTION. STRESS AT THE CONNECTION COULD CAUSE REPAIR TO FAIL. ENSURE PROTECTIVE CAPS REMAIN ON ENDS OF HARD WALL HOSE UNTIL JUST PRIOR TO ASSEMBLY. FAILURE TO COMPLY MAY INTRODUCE DIRT INTO THE SYSTEM AND SCAR THE METAL SEAL SURFACES.

NOTE:

If snap ring is excessively difficult to open, set the clamp aside and obtain another clamp. If the snap clamp lever is difficult to close, the end grooves and snap clamp are not aligned. Repair section must be long enough to allow a portion of hard wall hose to rest on the crater bottom, relieving stress exerted on the axial thrust coupling. Two parallel repair sections are required for 10- and 12-inch pipes. If additional length is required, use rigid 40-inch pipe sections whenever possible.

17.1. Remove hard wall hose and rigid pipe sections, as necessary, from the trailer.

17.2. If required, use adjustable pipe stands and bases to facilitate assembly of the repair section.

17.3. Remove and unpack alignment sleeve, snap clamp gasket, and snap clamp from component Schafer box.

17.4. Remove and discard protective caps from end of each hose section just prior to assembly.

17.5. Use gloves to remove any debris entering hose assembly during installation.

17.6. Install snap clamp gasket onto either end of hard wall hose being connected.

17.7. Insert alignment sleeve between two hose ends.

17.8. Position hard wall hose ends against alignment sleeve center ring.

17.9. Slide gasket over two hose ends and center over alignment sleeve center ring.

17.10. Place snap clamp loosely around gasket, align hose end grooves, and actuate snap clamp lever.

17.11. Position safety clip over the snap clamp handles and lock in place using a safety clip and wing nut.

Step 18: Attach repair section to pipeline adapter assembly as follows:

18.1. Move assembled hard wall hoses into the crater.

18.2. Position repair section end close to pipe adapter.

18.3. Remove and unpack snap clamp gasket, snap clamp, and alignment sleeve from component Schafer box.

18.4. Remove protective cap from end of hard wall hose being attached.

NOTE:

A pipe elbow may be added to pipe adapter if it will make alignment/attachment of hard wall hose easier.

18.5. Slide gasket over hard wall hose or pipe adapter.

18.6. Position and hold hard wall hose end against pipe adapter.

18.7. Center gasket ends over hard wall hose and pipe adapter ends.

18.8. Place snap clamp loosely around gasket and align hard wall hose and pipe adapter grooves with a snap clamp and actuate the snap clamp lever.

18.9. Position safety clip over snap clamp handle and lock in place using safety clip wing nut.

18.10. Repeat procedure at other pipeline end. Remove all tools and equipment, except ground assembly, from the crater.

Step 19: Test pipeline as follows:

SAFETY:
COMMUNICATION MUST BE MAINTAINED WITH PERSON RESPONSIBLE FOR PRESSURIZING THE PIPELINE WHILE TESTING IS IN PROGRESS. FAILURE TO MAINTAIN CONTACT COULD DELAY SHUTDOWN OR POL SYSTEM AND SERIOUS INJURY OR DEATH COULD RESULT.

19.1. Notify DCC that repairs are complete and coordinate pressure test.

SAFETY:
DO NOT STAND WITHIN 50 FEET OF PIPELINE WHEN BEING PRESSURIZED. IF REPAIR FAILS, SERIOUS PERSONAL INJURY OR DEATH COULD RESULT.

19.2. Pressurize pipeline, wait two minutes, then approach and observe repair section for leaks.

19.3. Report any leaks to DCC and request further instructions.

NOTE:
If leaks are reported, DCC will determine if further action is required.

Step 20: Return all components to their respective locations on the trailer and depart the area.

3.4. Bypass Repair. When conditions will not permit an in-crater repair, the bypass repair technique is an option. The following procedures are for 4-inch through 12-inch diameter fuel pipelines. The procedures for each diameter of pipeline are similar. Complete repair procedures are provided for 4-inch diameter pipeline. For 6-, 8-, 10-, and 12-inch pipeline, reference is made only to those procedures that differ from the 4-inch procedure. The bypass repair team is comprised of three team members. To minimize repair time, steps in the following repair procedures can be performed simultaneously.

3.4.1. Procedures for Bypass Repair Worksite Preparation and Set Up.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-4.5.

Step 2: Observe the Safety and Notes associated with the In-Crater repair worksite preparation and setup checklist.

Step 3: Examine pipeline location diagrams to select two general areas where bypass pits can be excavated.

Step 4: Using utility line tracer in accordance with procedures in Metrotech Corporation Utility Line Tracer commercial manual, locate pipeline and select two bypass pit areas at least 50 feet from the crater edge.

SAFETY:

1. WHEN EXCAVATING PIT, ENSURE SLOPE OF WALLS ARE NOT SO STEEP THE EARTH COULD MOVE OR A CAVE-IN COULD OCCUR. SHORING MAY BE REQUIRED TO STABILIZE PIT WALLS. MOVING EARTH OR A CAVE-IN COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

2. GUIDE BACKHOE OPERATOR DURING BYPASS PIT EXCAVATION OR ACCIDENTAL DAMAGE TO PIPELINE COULD RESULT.

Step 5: Continuously monitor LEL until repair is complete.

NOTE:
The upstream bypass pit should be excavated first.

Step 6: Determine backhoe requirements for excavation of bypass pit.

Step 7: Set up generator using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.3.

Step 8: Set up portable floodlights using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.4.

Step 9: Set up mast floodlights using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.5.

Step 10: Excavate pit, exposing at least 10 feet of pipe with two to three feet of space between pipe and bottom of pit and large enough for two people to work.

Step 11: Excavate an access/egress ramp.

Step 12: Position trailer and compressor using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.2.

Step 13: Determine need to drain crater and/or pipeline.

Step 14: If required, drain crater and/or pipeline with reciprocating pump using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.7 or coordinate with DCC to have crater drained.

NOTE:
Liquid in crater and/or pipeline may require draining to prevent liquid from flowing into the bypass pit when the pipe is cut. The amount of liquid in the crater and/or pipeline and the gravity flow at the bypass pits will dictate whether draining is required.

Step 15: Confirm DCC direction to discharge liquid on ground, in a holding pit, or a collapsible fabric tank.

Step 16: Place sounding device close to repair activity to use in notifying personnel to evacuate repair area.

SAFETY:

PERSONNEL SHOULD NOT ENTER WORK SITE AREA OR MUST EXIT, IF WORKING IN AREA, WHEN LEL IS GREATER THAN 1%. AN LEL GREATER THAN 1% REPRESENTS A BREATHING HAZARD. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

Step 17: Place automatic gas alarm sampling hose end as far into pit as possible.

Step 18: Continuously monitor LEL during pit preparation.

Step 19: Set up compressor using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.6.

Step 20: If liquid or fuel enters pit during work site preparation, use reciprocating pump to drain pit. Perform procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.7.

Step 21: Set up vaneaxial fan using procedures in T.O. 35D26-9-2-1, paragraph 4-4.3.10.

Step 22: Position tools and equipment using procedures in T.O. 35D26-9-2-1 paragraph 4-4.4.11.

NOTE:

The lay flat and hard wall hose should be assembled and installed on upstream pit pipeline before moving tools and equipment to downstream pit.

Step 23: Prepare downstream pit by repeating the procedures in this paragraph.

3.4.2. Procedures for Bypass Repair.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-5.3.2.

Step 2: Enter upstream pit and position the automatic gas alarm sampling hose end at the lowest point in the pit.

Step 3: Set automatic gas alarm to the ALARM position.

Step 4: If the LEL exceeds 1%, evacuate pit and place vaneaxial fan in pit using procedures in T.O. 35D26-9-2-1, paragraph 4-4.4.10.

Step 5: If LEL exceeds 1%, use the sounding device to notify personnel to evacuate repair area.

Step 6: Re-enter pit when LEL level is 1% or less.

Step 7: Use hand shovel and pick to expose entire circumference of pipe at cut locations.

NOTE:

The first cut in the upstream pit should be made on the pipeline end closest to the crater to facilitate installation of a flame arrestor to prevent fire from spreading through the pipeline from the crater.

Step 8: Designate exact location where cuts will be made.

NOTE:
There must be at least 5 feet between pipe cuts or 3 feet of a 90° elbow is used. A portion of the hard wall hose should rest on the ground to relieve stress exerted on the axial thrust coupling.

Step 9: Install ground clamp assemblies per procedures in T. O. 35D26-9-2-1, paragraph 4-5.2.2, steps i through m.

Step 10: If necessary, drain pipeline of fuel using tapping and fuel suction equipment as follows:

NOTE:
If residual fuel is in pipeline and cannot be drained by any other means, it should be drained while using the tapping and fuel suction equipment. The utility pail can be used to catch fuel that may continue to drip from the pipe. Unsaturated soil may be used to provide a vapor barrier.

10.1. Remove and set up reciprocating pump. Refer to T. O. 35D26-9-2-1, paragraph 4-4.4.7.

10.2. Remove $1^{1}/_{16}$-inch deep-well socket, 4-inch saddle clamp with corporation stop valve installed, tapping and fuel suction equipment, torque wrench and pipe wrench from the trailer.

NOTE:
The hole saw on the tapping tool should be checked to ensure the saw is sharp. Pipe plugs (coupons) should be removed from the hole saw if insufficient space exists in the hole saw to cut through the pipe.

10.3. Position saddle clamp on smooth section of pipeline, where tapping hole will be drilled, with valve in the **UP** position.

10.4. Install $1^{1}/_{16}$ inch deep-well socket on ½ inch drive ratchet.

10.5. If saddle clamp has three or more bolts, start in the center and work towards each end of clamp. Tighten nuts until snug.

10.6. If clamp has two bolts, alternate tightening nuts until snug.

10.7. Set torque wrench to 75 pounds and torque each nut to 75 ±8 foot-pounds.

10.8. Fully open saddle clamp corporation valve.

10.9. Pour pipeline coolant into valve until coolant pools in area where pipeline-tapping hole is to be cut.

10.10. Check hole saw to ensure saw is sharp and not filled with previous cuttings. Replace hole saw if required.

10.11. With cutting bit locked in up position, insert tapping tool in corporation valve assembly. Screw into valve until hand tight.

10.12. Using pipe wrench, tighten tapping tool until firmly attached to valve.

10.13. Unlock tapping tool cutting bit and lower bit through valve until it rests against pipeline surface. Lock bit in place.

10.14. Attach power head over tapping tool assembly and engage drive socket.

10.15. Ensure power head air valve is in **OFF** position.

10.16. Attach airline from air manifold to power head.

10.17. Slowly open power head air valve until cutting bit starts to turn and begins cutting tapping hole.

NOTE:

If air motor fails to rotate when air is applied, turn off air and manually rotate motor shaft to ensure it turns freely. If power head fails, the tapping hole can be cut manually using ratchet handle over the drive socket.

10.18. Slowly turn feed handle, avoiding binding, until feed handle reaches locking nuts.

10.19. Turn off air valve and disconnect hose.

10.20. Remove power head from tapping tool and set aside.

10.21. Retract cutting bit to UP position by turning feed handle.

10.22. Unlock and move cutting bit up through corporation stop valve. Close valve temporarily.

10.23. Using pipe wrench, remove tapping tool from saddle clamp and set aside.

10.24. Install suction tube assembly into corporation stop valve and hand tighten until snug using tightening handle provided.

10.25. Attach reciprocating pump suction hose to assembly. Open air valve and start pump.

10.26. Open corporation stop valve. Insert suction tube assembly into pipe until spring tip touches bottom of pipeline.

SAFETY:

DO NOT USE RECIPROCATING PUMP-TO-PUMP LIQUID FROM PIT WITHOUT STRAINER ATTACHED TO THE SUCTION HOSE. FAILURE TO USE THE STRAINER WILL ALLOW DEBRIS TO CLOG THE PUMP.

10.27. As pipeline empties, push suction tube assembly into pipeline and remove as much liquid as possible. When pipeline has been evacuated, turn the pump off.

10.28. Raise suction tube assembly to its highest point.

10.29. Close corporation stop valve.

10.30. Remove suction tube assembly.

Step 11: Make first cut in upstream pit per procedures in T. O. 35D26-9-2-1, paragraph 4-5.2.2, step o, with the following exceptions:

11.1. Position saw on pipeline with saw blade facing crater.

11.2. Disregard warning concerning pipeline suddenly detaching on the first cut.

11.3. After the first cut is complete, move saw to the second cut location.

Step 12: Install flame arrestor on first pipeline cut as follows:

12.1. Remove flame arrestor from component Schafer box.

12.2. Insert into first saw cut with mounting bracket away from section of pipe to be cut out.

12.3. Hold in place, wrap webbing around pipe, and attach hook to latch bracket.

12.4. Ratchet webbing buckle until flame arrestor is firmly secured to pipeline.

12.5. Remove corporation stop valve and saddle clamp from pipe.

SAFETY:

PIPELINE WILL DETACH SUDDENLY AND WITHOUT WARNING AT COMPLETION OF SECOND CUT. STAND CLEAR OF PIPELINE OR SERIOUS INJURY TO PERSONNEL COULD RESULT.

Step 13: Make second cut in upstream pit using same procedures for the first cut.

Step 14: If necessary, cut pipeline manually per procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2., step w or x.

Step 15: Remove cut out section of pipe only if it interferes with repair work.

15.1. If damaged section of pipeline is too heavy to move by hand, use wrecking bars, hand winch with strap or backhoe to move pipeline.

Step 16: Remove coating from pipeline end of the second cut per procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2, step q.

NOTE:

It will not be necessary to measure pipeline for roundness. If pipe has no coating, pipe still requires de-burring and cleaning per T. O. 35D26-9-2-1, paragraph 4-5.2.2, steps q (11) and (12).

Step 17: If necessary, remove pipeline coating manually per procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2, step y.

Step 18: Install pipeline adapter and axial thrust coupling on pipeline end per procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2, Step r.

NOTE:

Torque wrenches should always be reset to their lowest setting after use.

Step 19: Install bypass hose assembly as follows:

NOTE:

If required, use adjustable pipe stand and base to make installation of repair section easier. Two parallel hose assemblies are required for 10- and 12-inch pipe. A 90° elbow may be installed on pipe adapter to aid in routing hard wall hose out of pit to reduce load on axial thrust coupling.

19.1. Remove and discard protective caps from end of each hose section just prior to assembly.

19.2. Use gloves/rags to remove any debris entering hose assembly during installation.

19.3. Obtain hard wall hose and elbow.

19.4. Remove and unpack required snap clamp gaskets, snap clamps, and alignment sleeves from Schafer box.

19.5. Slide the snap clamp gasket on the pipe adapter.

19.6. Insert the alignment sleeve into the pipe adapter.

19.7. Position elbow against end of pipe adapter and turn in direction hard wall hose is to be routed.

19.8. Slide gasket over elbow end and center between elbow and adapter grooves.

19.9. Place snap clamp loosely around gasket.

SAFETY:

ALL END GROOVES SHOULD BE ALIGNED WITH THE SNAP CLAMP BEFORE ACTUATING LEVER OR DAMAGE TO GASKET COULD RESULT.

NOTE:

If snap clamp lever is difficult to close, the repair component end grooves are misaligned.

19.10. Align elbow, pipe adapter grooves, and snap clamp.

19.11. Actuate lever, position safety clip, and lock with wing nut.

Step 20: Position a hard wall hose at unconnected end of elbow.

Step 21: Connect hard wall hose end to elbow in same manner as connecting elbow to adapter in Step 19.

Step 22: Two personnel remove a section of lay flat hose from the trailer and unroll at the edge of the pit.

Step 23: Connect the lay flat hose to the hard wall hose end in the same manner as connecting the elbow to the adapter in Step 19.

NOTE:

An alignment sleeve is not used when connecting a lay flat hose to a hard wall hose.

Step 24: Route the lay flat hose toward the downstream pit area.

Step 25: Remove the ground wire assembly from the trailer.

Step 26: Attach a ground wire end to the grounding clamp on the pipe.

Step 27: Route a ground wire to reach the downstream pit. Attach a ground clamp and ground wire to the pipe near the downstream side of the crater.

SAFETY:

LAY FLAT HOSE MUST BE ROUTED SO THERE ARE NO BENDS WITH A RADIUS LESS THAN SIX FEET. A MINIMUM OF TWO LAY FLAT HOSES MUST BE USED IN A BYPASS REPAIR TO LESSEN THE EFFECTS OF PRESSURE SURGES.

Step 28: Remove sufficient lay flat hoses to reach downstream pit.

Step 29: Unroll lay flat hose sections end-to-end to edge of the downstream pit.

Step 30: Remove sufficient snap clamps and snap clamp gaskets to connect all lay flat hose sections.

Step 31: Install gaskets and clamps in same manner as Step 19.

Step 32: Remove tools and equipment, <u>EXCEPT</u> ground clamp assemblies and wires, from the pit.

Step 33: Disconnect air manifold ground cables. Place connected grounding wire ends into pit.

Step 34: Move all tools and equipment to downstream pit area.

Step 35: Set up tools and equipment at downstream pit, using same procedure as upstream pit.

Step 36: Perform repairs in downstream pit up to and including installation of hard wall hose, using same procedures as in the upstream pit.

Step 37: Connect grounding wire previously routed from upstream pit to the grounding wires attached to the two pipe ends.

Step 38: Connect previously assembled bypass hose assembly to unattached end of hard wall hose.

Step 39: Remove all tools and equipment, EXCEPT for grounding clamp assemblies and grounding wires, to pit edge. Place connected grounding wire into pit.

Step 40: Test repair per procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2, step u.

3.5. <u>Procedures for Valve Pit Repair</u>. Work site preparation and valve pit repairs can be made using in-crater or bypass repair procedures ***<u>except</u>*** one or more butterfly valves are installed so fuel flow can be directed or controlled. Valves, used with crosses and/or end caps provide multiple connection uses for butterfly valves. Crosses and/or end caps can be installed directly to other crosses or valves as needed.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-5.4.

Step 2: If type of repair has not been determined prior to arrival at the site, notify DCC of recommended repair configuration, advise, and await instructions; otherwise, proceed with the next step.

Step 3: Remove all the components required to make the valve repair from the trailer and lay them out near the repair site.

Step 4: Prepare pipeline ends for connection of adapters using procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2.

Step 5: Using pipe adapter size for diameter of pipeline, assemble adapter to pipe end using procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2.

Step 6: Connect hard wall hose to pipe adapters using procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2.

SAFETY:

NO MATTER WHAT COMBINATION OF VALVES, CROSSES AND/OR END CAPS ARE USED, NEVER CONNECT A BUTTERFLY VALVE, OR CROSS DIRECTLY TO A PIPE ADAPTER OR DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL COULD RESULT.

Step 7: Assemble any needed valves, valve spacers, lay flat hose, end caps, crosses, hard wall hose, snap clamps, and gaskets into a valve repair using previously learned procedures in T. O. 35D26-9-2-1, paragraphs 4-5.2.2 and 4-5.3.2 and as follow:

NOTE:

Valve pit repairs can be made to any size pipe. Procedures in T. O. 35D26-9-2-1, paragraph 4-5.2.2 apply to all diameter pipes with the exceptions detailed in paragraphs 4-5.2.3 through 4-5.2.6.

7.1. Ensure all valves are fully closed.

7.2. Connect valve spacers to butterfly valves.

7.3. Connect valves, crosses, end caps, hard wall hoses, and lay flat hoses needed for repair using snap clamps and gaskets.

NOTE:

Hand wheel on butterfly valve is offset. Always connect spacer to butterfly valve on hand wheel side.

Step 8: Connect valve repair assembly to hard wall hose.

Step 9: Test entire valve repair using procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2., Step u.

3.6. Procedures for End Cap Repair. You can use end caps to cap off a ruptured pipe after it has been cut and cleaned by installing an axial thrust coupling and pipe adapter to the pipe end, then installing a snap clamp, gasket, and end cap to the adapter.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-5.5.

Step 2: Cut and clean end of ruptured pipe.

Step 3: Install an axial thrust coupling and pipeline adapter to the end of the pipe.

Step 4: Install a snap clamp, gasket, and end cap to the pipeline adapter.

Step 5: Test entire valve repair using procedures in T.O. 35D26-9-2-1, paragraph 4-5.2.2., Step u.

3.7. Procedures for Puncture Repair. You can use a repair clamp to repair a hole in a pipe in these circumstances: the punctured pipe must be round and have no protrusions from the hole, and the hole must have a diameter small enough not to require cutting out a section of the pipe.

Step 1: Locate T.O. 35D26-9-2-1, Organizational Maintenance POL RURK.

1.1. Refer to paragraph 4-5.6.

Step 2: Measure largest diameter of hole. The diameter must be smaller than ½ the diameter of the pipe to be repaired.

Step 3: Thoroughly clean pipeline surface to be repaired. Remove as much dirt and corrosion as possible.

Step 4: Using a coarse file, remove any burrs or rough edges around the hole.

NOTE:
The pipe must be round and cannot have protrusions from the hole.

Step 5: If the pipeline is coated, do not remove the coating.

Step 6: Remove the proper size repair clamp from the trailer.

Step 7: Place marks on the pipeline showing where the ends of the repair clamp should align if properly positioned.

Step 8: If the pipeline repair surface is metal, apply a thin coat of 10W non-detergent oil, or a suitable substitute, to the clamp area.

Step 9: Back off clamp nuts to the end of the bolts, but do not remove the nuts.

Step 10: Separate clamp halves and place the half with the bolts attached to the top of the pipe.

SAFETY:
ENSURE NO FOREIGN MATERIAL STICKS TO THE CLAMP GASKET AS IT IS BROUGHT AROUND THE PIPE OR THE CLAMP MAY NOT SEAL PROPERLY AND A LEAK WILL RESULT.

Step 11: Slide the other clamp half into place and snap the bolt heads into open lugs. Tighten the bolt heads almost finger tight.

Step 12: Slide clamp over hole and align to pre-marked area.

Step 13: Ensure tails of clamp are properly overlapped and not folded.

Step 14: Using ½-inch drive ratchet with $1^{1}/_{16}$-inch deep-well socket, tighten clamp nuts until snug. Start at the center and alternate to either side.

NOTE:
Clamp may be rotated to facilitate seating of the tails.

Step 15: Using ½-inch drive torque wrench and $1^{1}/_{16}$-inch deep-well socket, torque clamp nuts starting in the center and alternating to either side.

15.1. Torque 4-inch diameter clamp to 50 foot-pounds.

15.2. Torque 6-, 8-, 10-, and 12-inch diameter clamps to 50 foot-pounds and then to 75 foot-pounds.

15.3. Wait 20 minutes and re-torque nuts.

Step 16: Test puncture repair using procedures in T. O. 35D26-9-2-1, paragraph 4-5.2.2, Step u.

OPERATE/MAINTAIN RURK I

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
Set-up RURK for Inspection, Service, and Operation Checks		
1. Review the POL RURK historical records		
2. Select the correct site for the inspection		
3. Obtain common and bulk items from LFM shop for the inspection and service		
4. Move the trailer and compressor to the inspection area with the correct vehicle		
5. Set the parking brake and unhook trailer		

DID THE TRAINEE….?	YES	NO
Perform Inspection and Operational Checks on Trailer		
1. Inspect the frame and exterior surface for rust, corrosion, and made repairs correctly		
2. Inspect tire for damage and replaced if needed		
3. Inflate tires to the correct pressure		
4. Grease all trailer grease fittings		
5. Repack wheel bearing correctly		
6. Inspect and test parking brake correctly		
7. Inspect and repair wiring and electrical connectors correctly		
8. Check all brake, turn signal, and running lights for proper operation (replace bulbs if needed)		
9. Inspect door latches, hinges, and lightly oil them		
10. Inspect tongue and safety chain correctly		

DID THE TRAINEE….?	YES	NO
Perform Inspection and Service on Compressor		
1. Inspect compressor for external damage and security of components correctly		
2. Check fuel and oil levels (added fuel or oil if needed)		
3. Inspect all hoses for kinks, wear, and damage to pins (repair or replace as needed)		
4. Perform an operational check on compressor correctly		
5. Shut down compressor correctly		

PERFORMANCE CHECKLIST (Continued)

DID THE TRAINEE….?	YES	NO
Perform Inspection and Service on Generator		
1. Unpack and remove the generator correctly		
2. Set up the generator correctly		
3. Install the battery correctly		
4. Connect a ground wire (local or install grounding rod)		
5. Test and shut down the generator correctly		
6. Repackage the generator for extended storage correctly		

DID THE TRAINEE….?	YES	NO
Inspection and Operational Checks on Essential Tool Kit		
1. Obtain tool kit from trailer		
2. Conduct an inventory		
3. Inspect each tool for serviceability and corrosion		
4. Clean and lightly oil each tool		
5. Check flashlights		
6. Repack tools		

DID THE TRAINEE….?	YES	NO
1. Obtain automatic gas alarm from trailer and inspect packaging		
2. Unpack and inventory items in the kit		
3. Check meter calibrate date (if needed turn in to PMEL for servicing)		
4. Perform an operationally test correctly		
5. Repack and place in storage correctly		

DID THE TRAINEE….?	YES	NO
Inspect and Operational Checks on Utility Line Tracer		
1. Obtain utility line tracer from trailer and inspect packaging		
2. Perform operational and calibrate check IAW manufacturer' manual		
3. Repack and place back in storage correctly		

DID THE TRAINEE….?	YES	NO
Inspect and Operational Checks on Portable Floodlights		
1. Remove ground fault interrupters (GFIs) from trailer and connect to generator		
2. Obtain portable floodlights and inspect for damage and/or deterioration		
3. Start generator and plug in portable floodlights in GFI for proper operation		
4. Replace lamp correctly (if required)		
5. Repack and place portable floodlights in storage correctly		

PERFORMANCE CHECKLIST (Continued)

DID THE TRAINEE….?	YES	NO
Inspect and Operational Checks on Mast Floodlights		
1. Remove ground fault interrupters (GFIs) from trailer and connect to generator		
2. Obtain mast floodlights and inspect for damage and/or deterioration		
3. Start generator and plug in portable floodlights in GFI for proper operation		
4. Replace lamp correctly (if required)		
5. Repack and place mast floodlights in storage correctly		

DID THE TRAINEE….?	YES	NO
Inspect and Operational Checks on Deicer Assembly		
1. Obtain deicer from trailer and inspect packaging		
2. Service the deicer IAW manufacturer manual		
3. Inspect and operate deicer IAW manufacturer manual		
4. Repack and place deicer in storage correctly		

NOTE TO TRAINER:

In order for the trainee to accomplish the following tasks, you must build an exercise scenario where a fuel pipeline has been damage. Using T.O. 35D26-9-2-1 have the trainee identify the problem and perform the correct repair procedure IAW the technical order.

DID THE TRAINEE….?	YES	NO
Assess Pipeline Damage		
1. Approach the damage crater correctly (upwind and uphill)		
2. Lower the automatic gas alarm sampling hose correctly		
3. Assess damage to the pipeline		
4. Determine crater preparation requirements		
5. Notify the DCC of the damage		

DID THE TRAINEE….?	YES	NO
Work Site Preparation Requirements		
1. Determine the crater: 1.1. Entry 1.2. Exit 1.3. Trailer location 1.4. Compressor location		
2. Determine the requirement for pumping out crater		
3. Notify DCC of the requirement		
4. Determine the need for a backhoe		

PERFORMANCE CHECKLIST (Continued)

DID THE TRAINEE….?	YES	NO
Position Trailer and Compressor		
1. Position the fire extinguisher correctly		
2. Position the compressor at least 50 feet from and upwind of the crater		
3. Position the trailer correctly		

DID THE TRAINEE….?	YES	NO
Generator Set Up		
1. Position the generator at least 50 feet from and upwind of crater		
2. Set up the generator IAW T.O. 35C2-3-499-1		
3. Install ground rod correctly		

DID THE TRAINEE….?	YES	NO
Portable Floodlights Set Up (If Required)		
1. Start the generator		
2. Remove the portable floodlights, power cable extensions, and GFCIs from trailer		
3. Connect GFCIs to generator receptacles		
4. Connect portable floodlights to GFCIs		
5. Position floodlights		

DID THE TRAINEE….?	YES	NO
Mast Floodlights Set Up		
1. Remove mast floodlights and power cable extension from trailer		
2. Position mast floodlights around crater		
3. Start generator (if required)		
4. Connect GFCIs to generator receptacles (if required)		
5. Connect mast floodlights to GFCIs		
6. Adjust mast floodlights		

DID THE TRAINEE….?	YES	NO
Compressor Set Up		
1. Set up compressor IAW 34Y1-184-21		
2. Position airline manifold and deicer assembly at crater edge		
3. Connect air manifold ground wire to grounding rod		
4. Attach compressor airlines to deicing assembly correctly		
5. Attach deicing airlines to airline manifold correctly		
6. Start compressor and confirm air pressure correctly		

PERFORMANCE CHECKLIST (Continued)

DID THE TRAINEE….?	YES	NO
Diaphragm Pump Set Up (If Required)		
1. Remove required components from trailer		
2. Attach suction strainer correctly		
3. Attach suction hose correctly		
4. Position suction strainer correctly		
5. Route discharge hose correctly: 7.1. If draining on the ground to the downhill side of the crater 7.2. Collapsible fabric tank		
6. Set up collapsible fabric tank correctly		
7. Connect airline correctly to: 7.1. Reciprocating pump and airline manifold 7.2. Diaphragm pump and airline manifold		
8. Shut off diaphragm pump correctly		

DID THE TRAINEE….?	YES	NO
Crater Preparation		
1. Use backhoe to remove/place soil correctly		
2. Expose at least three feet of undamaged pipeline		
3. Prepare work area correctly		
4. Create access and exit ramp correctly		

DID THE TRAINEE….?	YES	NO
Vaneaxial Fan Set Up		
1. Remove required components from trailer		
2. Position vaneaxial fan correctly		
3. Set up fan correctly		

DID THE TRAINEE….?	YES	NO
Tool and Equipment Set Up		
1. Remove required components from trailer		
2. Position tools at crater entry way		
3. Install blade in power hacksaw		
4. Determine the correct repair procedure		
5. Place repair components in Schafer boxes		

PERFORMANCE CHECKLIST (Continued)

DID THE TRAINEE….?	YES	NO
In-Crater Repair		
1. Position/set up automatic gas alarm correctly		
2. Expose at least three feet of the pipeline		
3. Select/mark cut locations on both sides of damaged pipeline		
4. Check pipeline for roundness and straightness		
5. Select/place correct repair parts in Schafer boxes		
6. Measure the area to be replace correctly		
7. Install grounding clamp correctly		
8. Drain pipeline correctly (if required)		
9. Cut pipeline with power hacksaw correctly		
10. Removed damaged pipeline section (if required)		
11. Remove pipeline coating correctly		
12. Install pipe adapter and axial thrust coupling correctly		
13. Assemble pipeline repair section correctly		
14. Attach repair section to pipeline adapter correctly		
15. Test pipeline repair correctly		
16. Return all components to their respective location on the trailer		

DID THE TRAINEE….?	YES	NO
Bypass Repair Worksite Preparation and Set Up		
1. Observe safety and notes associated with in-crater repair		
2. Use the utility line tracer correctly		
3. Select two pipeline location for the bypass repair correctly		
4. Set up/monitor the automatic gas alarm correctly		
5. Determine backhoe requirements		
6. Set up/use generator correctly		
7. Set up/use portable lights correctly		
8. Set up/use mast floodlights correctly		
9. Excavate pit to exposed at least 10 feet of pipeline		
10. Excavate an access/egress ramp correctly		
11. Position trailer and compressor correctly		
12. Determine if the crater/pipeline needed to be drain of fuel		
13. Notify DCC of the draining requirements		
14. Set up/use reciprocating pump correctly (if required)		
15. Set up/use compressor correctly		
16. Set up/use vaneaxial fan correctly (if required)		
17. Position tools and equipment for the repair correctly		
18. Prepare downstream pit using these procedures		

PERFORMANCE CHECKLIST (Continued)

DID THE TRAINEE….?	YES	NO
Bypass Repair		
1. Position the automatic gas alarm sampling hose correctly into pit		
2. Monitor automatic gas alarm correctly		
3. Expose entire circumference of pipe		
4. Select location for the cut		
5. Install grounding clamp correctly		
6. Drain pipeline correctly (if required)		
7. Make the first cut correctly		
8. Install flame arrestor correctly		
9. Make second cut in upstream pit using the same procedures outline in this checklist		
10. Remove cut out damaged section (if required)		
11. Remove coating from both pipelines correctly		
12. Install pipeline adapters and axial thrust couplings correctly		
13. Position/install bypass hose correctly		
14. Connect grounding wire correctly		
15. Test repair correctly		
16. Remove/place tools and equipment back on trailer correctly		

DID THE TRAINEE….?	YES	NO
Valve Pit Repair		
1. Position the automatic gas alarm sampling hose correctly into pit		
2. Monitor automatic gas alarm correctly		
3. Remove the components required for the repair from the trailer and place them the repair site		
4. Prepare pipelines ends correctly		
5. Use correct pipe adapters for the pipeline repair		
6. Connect hard wall hose to adapters correctly		
7. Assemble valve(s) correctly		
8. Connect valve repair assembly to hard wall hose correctly		
9. Test valve repair correctly		
10. Return tools and equipment to trailer		

DID THE TRAINEE….?	YES	NO
End Cap Repair		
1. Position the automatic gas alarm sampling hose correctly into pit		
2. Monitor automatic gas alarm correctly		
3. Remove the components required for the repair from the trailer and place them the repair site		
4. Cut and clean end of ruptured pipe correctly		

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORMANCE CHECKLIST (Continued)

5. Install an axial thrust coupling and pipeline adapter correctly		
6. Install end cap correctly		
7. Test valve repair correctly		
8. Return tools and equipment to trailer		

DID THE TRAINEE….?	YES	NO
Puncture Repair		
1. Position the automatic gas alarm sampling hose correctly into pit		
2. Monitor automatic gas alarm correctly		
3. Remove the components required for the repair from the trailer and place them the repair site		
4. Measure the hole (is it smaller than ½ the diameter of the pipe)		
5. Clean the area that is to be repaired		
6. Select the proper size repair clamp		
7. Mark the pipeline to show the ends of repair clamp		
8. Apply a tin coat of 10W non-detergent oil		
9. Install repair clamp correctly		
10. Test puncture repair correctly		
11. Return tools and equipment to trailer		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

POL DISTRIBUTION SYSTEM REPAIR

RAPID UTILITY REPAIR KIT (RURK)

MODULE 20 **AFQTP UNIT 1**

OPERATE/MAINTAIN CONTINGENCY FUELS RECOVERY SYSTEM (CFRS) (20.1.3.3.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

OPERATE/MAINTAIN CONTINGENCY FUEL RECOVERY SYSTEM

Task Training Guide

STS Reference Number/Title:	20.1.3.3., Operate/Maintain Contingency Fuel Recovery System (CFRS)
Training References:	*1.* Technical Order (T.O.) 37A13-5-1, *Organizational and Maintenance Instructions, Contingency Fuel Recovery System (CFRS), Portable Fuel Transfer Unit (PFTU).* 2. T.O. 37A13-6-2, *Maintenance Instructions, CFRS Fuel Scavenging Unit (FSU).* 3. T.O. 00-25-246, *Tire and Wheel Maintenance.* 4. T.O. 1-1A-15, *General Maintenance Instructions for Support Equipment.* 5. T.O. 3G1-113-3, *Portable Fuel Transfer Unit Diesel Engine.* 6. T.O. 37A-1-101, *Filter/Separator.* 7. T.O. 37A13-6-1, *Fuel Scavenging Unit.* 8. T.O. 38G1-108-3, *Hatz Engine, Model 3M40L Maintenance.*
Prerequisites:	1. **Possess as a minimum a 3E432 AFSC.** 2. **Review the following references:** 2.1. T.O. 37A13-5-1. 2.2. T.O. 37A13-6-2. 2.3. T.O. 00-25-246. 2.4. T.O. 1-1A-15. 2.5. T.O. 3G1-113-3. 2.6. T.O. 37A-1-101. 2.7. T.O. 37A13-6-1. 2.8. T.O. 38G1-108-3. 3. **Complete CD-ROM, AFQTP 3E4X2, Liquid Fuel Systems, Version 1.0, Sep 01: Contingency Fuel Recovery System (CFRS)**
Equipment/Tools Required:	1. Computer to support CD-ROM AFQTP (To be released Sep 02) 2. Contingency Fuel Recovery System. 3. Transport Vehicle. 4. Common toolbox. 5. Fire Extinguisher.
Learning Objective:	1. Given T.O. 37A13-5-1 and 37A13-6-2, trainee should know basic operation of the Contingency Fuel Recovery System.
Samples of Behavior:	1. Trainee will be able to service/maintain, set-up/operate, and pumping/transferring fuel using the CFRS in a contingency environment.
Notes:	
1. To successfully complete this element, the steps must be followed exactly--no exceptions. 2. Any safety violation is an automatic failure. 3. You **must** follow the detailed procedures in T.O. 37A13-5-1 and 37A13-6-2 when serving, maintaining, setting up, and pumping/transferring fuel. The type of transfers and individual components requires specific step-by-step procedures when unpacking and setting up, and transferring petroleum products.	

OPERATE/MAINTAIN CONTINGENCY FUEL RECOVERY SYSTEM (CFRS)

1. Background: In today's world of fast paced contingency, it is critical that Liquid Fuels Maintenance Specialists be able to remove and filter fuel quickly and accurately. This ensures aircraft the ability to strike in a moment's notice and be provided with a clean, uninterrupted supply of fuel.

1.1. This system is designed to support the Civil Engineer forces with all the necessary equipment, materials, and tools to rapidly make repairs to POL areas that have sustained damage due to natural disasters as well as war damaged. The CFRS is also designed to be used with the POL RURK I system. The rapid recovery of fuel storage, pipelines, and hydrant systems is an essential element of an air base wartime capabilities to provide a fighting platform for air warfare.

2. Description: The Contingency Fuel Recovery System (CFRS) (Figure 1) is comprised of two self-contained, portable, sub-units: Fuel Scavenging Unit (FSU) and Portable Fuel Transfer Unit (PFTU). The FSU is made up of a submersible pump and a hydraulic power unit. This sub-unit is used to provide the hydraulic pressure to operate the submersible pump, which removes jet fuel from tanks and delivers it to the PFTU. The PFTU, filters and delivers the jet fuel to the distribution system, another storage tank, refueling vehicles, or an aircraft.

2.1. The critical items of the CFRS are the pumps, filters, valves, monitoring devices, power source(s), and hoses required to extract jet fuel from storage and pump it into aircraft, refueling vehicles, or a distribution network. Proper storage is provided to store and protect all tools, materials, and equipment necessary for CFRS operation.

2.2. The CFRS is capable of pumping fuel from cut and cover, underground, and aboveground storage tanks if the tie-in fitting is damaged or inoperable. Access to the storage tanks is gained through a top access way as small as 24 inches in diameter. A submersible pump, stowed on the FSU, is lowered into the tank with a tripod/winch assembly, which is stowed on the PFTU. The submersible pump is powered by the FSU. All tools required to allow access to the tank and interface the submersible pump with the PFTU are included with the system. The capability to extract fuel from inoperative aboveground tanks is provides through the use of adapters to connect a hard-wall hose to the low-point drain shutoff valve flange.

2.3. The output of the submersible pump is delivered to the PFTU which can output at low-pressure (55 psi) to a single-point nozzle, a 3" camlock fitting, or a 3" ANSI Class 150 flange; and at high-pressure (130-150 psi) to a 3" camlock fitting. Adapters are included to connect to a fuel system riser, a POL RURK hard-wall hose, and a flanged valve pit connection.

2.4. To the greatest extent possible, the CFRS emphasizes safety, speed, simplicity, and use of Government inventory and commercial off-the-shelf tools, materials, and equipment.

PFTU

FSU

Figure 1. Contingency Fuel Recovery System

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

3. Components of the PFTU: The PFTU and consists of a diesel engine, fuel tank with sight gage, and controls; self-priming centrifugal pump and strainer; horizontal API filters/separator; expansion tank with sight gages; venturi; refueling hose and reel; dead man switch; and bonding reels. Automatic valves provide pressure relief and flow control. In addition, various local- and remote-reading gages and fittings are included. All fixed components are cart-mounted. All tools, equipment, monitoring/shut down devices, and testing devices needed to operate the PFTU are supplied on-board the cart. Hoses, dry break connectors, a tripod and winch assembly, plus pipeline adapters and tools are also supplied.

3.1. Diesel Engine: The diesel engine (Figure 2) is mounted on the front of the cart, which is used to drive the centrifugal pump. It is equipped with a belt driven alternator and cooling fan. The engine is monitored for low oil pressure, charging voltage, engine rpm, accumulated operating hours, and high operating temperature.

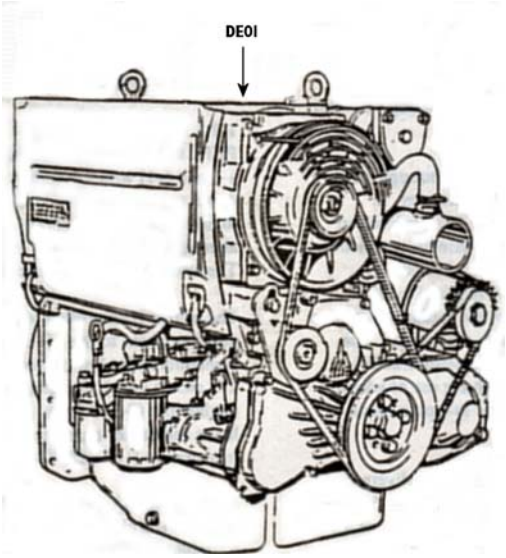

Figure 2. PFTU Diesel Engine

3.2. Centrifugal Pump: The centrifugal pump (Figure 3) is a non-positive displacement centrifugal model, with a closed impeller and no check valve installed. The pump is mounted at the front of the cart directly to the engine. The suction side of the pump is equipped with a vacuum switch set for 15” Hg to shut down the diesel engine when it detects a cavitation. There is an override function to defeat the vacuum switch. The operator must continually hold the override push button to activate this function. The discharge side of the pump is equipped with a two-stage temperature switch to detect the temperature of the fuel. The first-stage is 140^0 F, the second-stage is 180^0 F. On the first-stage set-point the switch will operate and energize an audible alarm and a flashing amber beacon. There is an override function installed to allow the operator to silence the audible alarm and a blackout function to suppress the flashing beacon. The second-stage set-point will operate and cause the diesel engine to shut down. The override function must be pressed and held to activate this function. Lastly on the discharge line of the pump there is a thermometer for visually observing the fuel temperature.

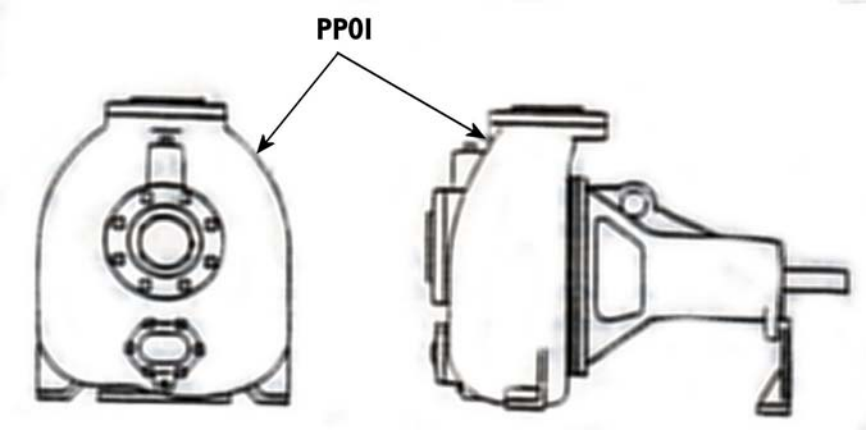

Figure 3, PFTU Centrifugal Pump

3.3. Filter/Separator (F/S): The filter/separator (Figure 4) is installed after the pump and is located on the left-hand side of the trailer behind the diesel engine. All fuel that is pumped through the unit is filtered to ensure purity and water removal. The vessel is equipped with an air eliminator, 200-psi pressure relief valve, manual drain, float switch operated slug control, differential pressure indicator and gage, and two sampling connections. The vessel is required to be cleaned and the filters changed out at a maximum of l5-psi DP.

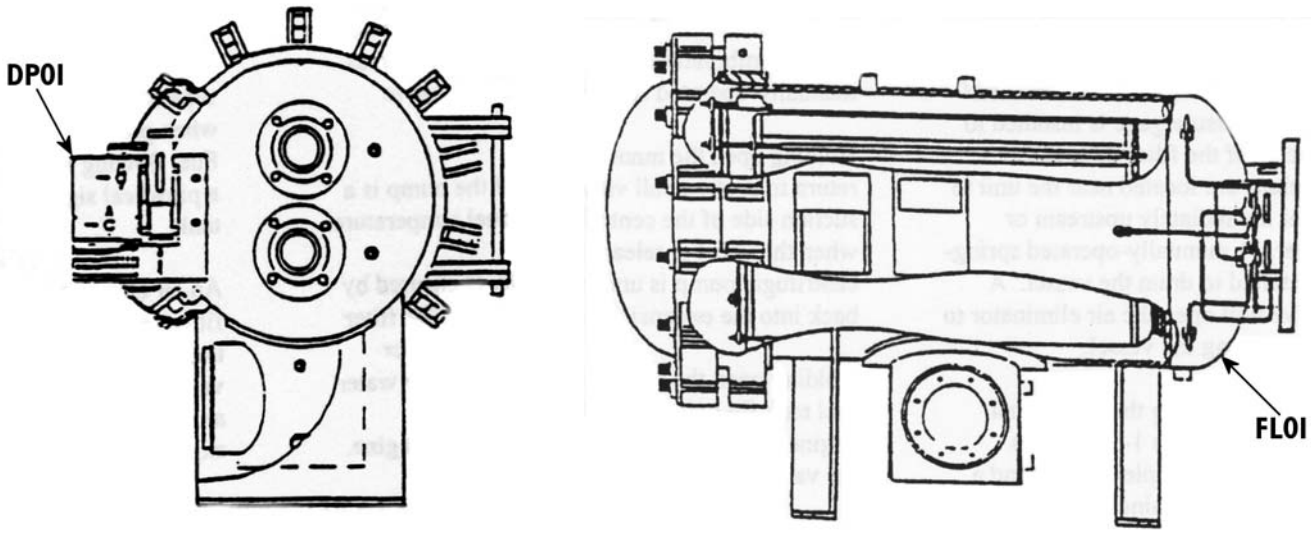

Figure 4. PFTU Filter/Separator

3.4. Strainer: All fuel entering the PFTU first passes through the strainer. The strainer (Figure 5) is equipped with a simplex basket and a quick-opening access cover. A strainer drain spring-return ball valve is installed for draining the strainer or sampling the fuel. The strainer is mounted at the curbside of the PFTU.

Figure 5. PFTU Strainer

3.5. Expansion Tank: The expansion tank (Figure 6) is provided as a temporary storage for fuel / air which is routed to the tank from the air eliminator, and pressure relief, it has a 15-gallon capacity. The tank is located behind the refueling hose reel on the left-hand side of the trailer. A N/C float switch is installed in the tank to monitor the fuel and shut down the diesel engine before it overflows the tank; this function cannot be overridden. A sight glass is installed for a visual indication. Fuel in the tank can be routed to any combination of three locations by holding the manually operated spring4oaded ball valves. Holding open the spring-loaded ball valve will allow the operator to fill the engine fuel tank for self filling, to the suction side of the pump (if the suction side of the pump is under pressure fuel will flow into the expansion tank), and into the drain line located in the right hand rear corner of the unit.

Figure 6. PFTU Expansion Tank

3.6. Venturi: The venturi (Figure 7) is installed to provide an accurate indication of the pressure at the underwing/single-point nozzle. The venturi is located below the refueling hose and reel on the rear of the cart.

Figure 7. PFTU Venturi

3.7. Refueling Hose and Reel: The refueling hose and reel (Figure 8) is a 2-inch X 75-feet semi-hardwall hose with male threaded compressed end couplings on both ends. The hose is connected to the low-pressure output line and may be equipped with either; a diesel automotive-type nozzle, or an underwing single-point nozzle, both equipped with a 2-inch Quick-Connect Male coupling. The hose is stored on the reel, which is a manual-unwound electrically rewound reel. The rewind motor is operated from the rear of the cart from a push button to the left of the reel only if the circuit breaker is on and the reel release handle is pulled out.

Figure 8. PFTU Refueling Hose and Reel

3.8. Automatic Control Valves: There are two automatic control valves, which are hydraulically actuated with pilot controls and solenoids activation, located on the right-hand side of the cart.

3.8.1. The first valve is the 59 AF, ByPass valve (Figure 9a), it is installed in a by pass line between the inlet of the strainer and the outlet of the pump to the F/S. This valve is a dual pressure valve with solenoid selection of setting. The valve provides relief for the centrifugal pump. It is a 50 series valve; it is installed with the flow under the disc and seat for a fail-safe feature in case of diaphragm failure.

Figure 9a. PFTU Pump Pressure (ByPass) Relief Valve

3.8.2. The second valve is the 49-49 System Pressure Control Refueling Valve (Figure 9b); it is located down stream of the F/S. This valve is a dual circuit, multi-purpose valve. It is a 40 series valve installed in normal flow with flow under the diaphragm. The valve can be used for low/high-pressure discharge by moving the pressure mode selection switch on the alarm electrical panel, which will energize/de-energize the two three-port solenoids. The valve maintains flow through the filter separator ensuring not to exceed the rating on the F/S and the pump curve, by means of two differential pressure controls (CDHS-2). The valve maintains a constant down stream pressure in the low-pressure mode by means of a pressure reducing control (CRD). The valve protects against pressure surges when the down stream pressure becomes excessive, and thermal relief. It will close the main valve in the low/high pressure mode, relieve the down stream pressure back to the inlet side of the valve, by means of two pressure relief controls (CRL). The valve has a controlled opening rate by means of a CV Flow Control.

Figure 9b. PFTU System Pressure Control Refueling Valve

3.9. Deadman Switch: The deadman switch (Figure 10) controls the low-pressure output section of the 4949 System pressure Control Refueling Valve. Squeezing the handle activates the valve solenoids to refuel in the low-pressure mode, releasing the handle stops the fuel flow and deadheads the system. The deadman switch and cable reel is located on the right hand rear side of the cart. The reel has 75 feet of cable, which is manually unwound and mechanically rewound.

Figure 10. PFTU Deadman Switch

3.10. Bonding Reels: There are a total of 5 bonding cables/reels with the unit. When these cables are properly used they will prevent the buildup of electrostatic charges from transferring fuel and reduce the risk of explosion. The first is a permanently installed bonding reel (Figure 11a) to bond the PFTU to the FSU with 75 feet of bonding wire with a clamp. This reel is manually unwound and mechanically rewound. There are two portable bonding reels (Figure 11b) with 200 feet of bonding wire with a clamp on each end. One reel is used to bond the PFTU to the point of delivery; the other is a spare. Each bonding wire is manually unwound and rewound. Both bonding reels are mounted on the right rear side of the unit. The last two bonding cables are 10 feet long with clamps on each end to bond the tank-to-tripod and tank-to-access cover. The cables are stored in the storage cabinet.

Figure 11a. PFTU Permanently Installed Bonding Reel

Figure 11b. Portable Bonding Reel

3.11. Emergency Stop: There is a red mushroom-shaped emergency stop control button (Figure 12) on the unit to shut down the PFTU diesel engine in case of an emergency such as a fire, fuel leak, smoke, sparks, or under an attack. This function cannot he overridden. It is located at the rear of the cart to the right of the refueling reel.

Figure 12. PFTU Emergency Stop Switch

3.12. Gage Panel: The gage panel (Figure 13) provides the operator with ongoing pressure and vacuum monitoring of the transfer operations. The panel is located on the front right side of the unit between the pump and diesel engine. The panel has five monitoring gages:

3.12.1. Pump Suction Vacuum Level.
3.12.2. Pump Discharge Pressure.
3.12.3. Nozzle Outlet Pressure.
3.12.4. Low-Pressure Discharge.
3.12.5. High-Pressure Discharge.

Figure 13. PFTU Gage Panel (Pressure)

3.13. Engine Controls: The engine control panel (Figure 14) provides the operator with the starting and monitoring function of the diesel engine. The panel has four gages, four push-buttons/switches, two indicator lights, and fuse holder. The gages display the oil pressure, amps, cylinder head temperature, and engine RPM. The push-button/switches are On/Off, Preheat, Engine start, and override. The indicator lights laminate red when the Preheat push-button is pressed, and alternator Failure. The oil pressure and temperature gages each have a built in electrical switch, which shuts down the engine under low oil pressure or high engine head temperature conditions. Low oil pressure shut down is any pressure at or below 30 psi. High engine temperature shutdown is 255^0 F. The control panel is located on the front right side of the unit between the pump and diesel engine below the gage panel. Engine rpm is controlled by the throttle lever on the side of the engine and monitored by the gage on the gage panel.

Figure 14. PFTU Engine Controls Panel

3.14. Master Electric Panel: The master electric panel (Figure 15) contains a main on/off switch, master panel power on indicator (white), three circuit breakers, and a red reset button. Circuit breaker # 1 and #2 are 50 amps each, circuit breaker # 3 is 10 amps. The panel is located on the front right side of the unit above the pump.

Figure 15. PFTU Master Electric Panel

3.15. Control and Alarm Electric Panel. The control and alarm electric panel (Figure 16) contains a control and alarm panel power switch, low pressure mode on indicator (green), high pressure mode on indicator (red), pressure mode selection switch, high temp stage 1 alarm, push to test alarms pushbutton, audible alarm silence pushbutton, safety system override temp/vacuum, blackout mode high temp warning indicator, and a blackout mode selection switch. The panel is located on the front right side of the unit above the gage panel.

Figure 16. PFTU Control and Alarm Electric Panel

3.16. Cart. The cart is a four-wheel steel-deck with pneumatic tires and a spare mounted on the right-band side. The unit is equipped with a manually operated parking brake located in the front. The front wheels are steerable via the towbar. The unit has a pintle hook on the rear of the unit to allow for towing the FSU. There are storage compartments provided under the front, rear, and left side of the unit for storing the F/S filters, hardwall hoses, tripod and winch, and spare parts. There is also a storage compartment with pullout drawers installed on the unit; between the F/S and the refueling hose reel, accessible from both sides.

3.17. Hoses. All of the hoses supplied with the unit are 3-inch inside diameter with internally-compressed brass ends and stainless steel camlock connections. Each hose is fitted with a camlock cover and plug. There are 10 each 10-foot hardwall, 2 each 100-foot layflat, and 2 each 50-foot layflat hoses provided on the unit. The hardwall hoses are stored in the rear of the unit. The two 50-foot layflat hoses are stored in the left-hand side upper storage box, while the two 100-foot layflat hoses are stored in a rack on the rear of the unit above the fuel tank, near the expansion tank, and the refueling hose reel.

3.18. Dry-break Connectors. Ball valves are to be used as drybreak connectors between the hardwall hoses and the suction/discharge fittings on the unit. They are stored in the left hand side, upper storage compartment.

3.19. Tripod/Wrench Assembly. The tripod and winch assembly (Figure 17) is used on underground, and cut-and cover tanks to lower the submersible pump into them. It may also be used to aid in removing the access way cover. The winch is hand operated and has 65 feet of steel cable. The tripod has adjustable legs up to 7 inches to allow for unleveled ground around the access way, and allow for more space to raise/lower the pump. The whole unit has a max load rating of 600 lbs. The assembly is stored along with the hardwall hoses in the rear of the unit.

Figure 17. PFTU Tripod/Wrench Assembly

3.20. Accessories. There is quite a comprehensive list of all the items installed on or furnished on board the PFTU. Adapters for various pipeline sizes are included with elbows and fittings to attach fuel transfer hoses from the PFTU and which allows fuel to be returned to distribution piping after extraction and filtration. Pipeline tools and specific tools to repair engine and tubing are included in the storage compartments. Certain spare parts are also included to allow unsupported operation for up to ninety days. For deployments up to a year, a PFTU deployment critical spares box is maintained at USAFE and PACAF Silver Flag training sites.

3.21. Support Tools. The CFRS requires common tools and equipment available in shop environments for operation. The support tools are not provided with the PFTU, however they are generally found in the LFM PRIME BEEF tool kit.

3.22. Additional Support Equipment for PFTU. In some situations additional support equipment will be needed to use the CFRS. The assets in the POL RURK 1 can be utilized with the CFRS.

4. Items of a FSU. The FSU is a self-contained unit, which may, or may not be utilized with the PFTU depending on the tank configuration. The unit is a diesel driven hydraulic power system, which provides powers to the submersible pump. Due to the depth of some tanks it was found that most pumps that we use in and around the fuel system would not push/pull the product out of the tanks. For this reason a hydraulic pump was selected to do the job. Using hydraulic pressure to power the submersible pump unsure that the product will be removed from the tank no matter what type of product it is.

4.1. Diesel Engine. The hydraulic system is powered by the diesel engine on the FSU. The speed control is maintained by the variable-speed closed linkage mechanical governor at 2450 rpm normally.

4.2. Hydraulic Pump, Reservoir; and Submersible Pump. The hydraulic pump is powered by the diesel engine and is supplied fluid by the 50-gallon fluid reservoir. There are various fittings, piping and a high-pressure filter within the system to route and filter the fluid. The unit has two external high pressure hoses; one rated for 2250 psi to supply the submersible pump, and the other one rated at 1200 psi to return the fluid back to the reservoir.

4.3. Bonding Reel. The unit is equipped with a bonding reel mounted on the rear of the unit to bond the unit to the tank. It contains 150-feet of wire cable with a clamp.

4.4. Remote Emergency Stop Push-button and Cable Reel Assembly. Due to the hazards associated with using hydraulic pressure to run the submersible pump the unit is equipped with a remote emergency stop button. The emergency stop control is wired into the engine controls, when activated the engine will shut down; however the hydraulic pressure will still be present in the hoses until relieved by manually turning the pressure supply valve counterclockwise unless the hose ruptured. The stop button is located on the rear of the unit and is attached to a spring retracted cable reel to allow the operator to position it on or near the front of the PFTU near the control panel. Once activated, the switch will have to be pulled out to close the circuit before the unit will start again.

4.5. Engine Controls, Pumping Controls, and Indicators. The controls and indicators are mounted on or near the instrument panel, which is accessible by opening the cover panel access door on the left-hand side of the unit.

4.6. Accessories for the FSU. There is a box located on the right-hand side of the unit in the engine compartment for immediate use spare parts. If the unit is to be deployed for a year or longer a box of deployed critical spares can be requested from Command Silver Flag Sites.

5. Operation Procedures. The POL Pipeline Rapid Utility Repair process begins prior to need. Continued training, planning, and preparation are critical. Pre-operational preparations must be identified, coordinated, and completed before the need is imminent. After an attack or natural disaster, Damage Assessment and Response teams (DARTs) will assess and report damage to jet fuel storage and pumping resources that will require use of the CFRS. Repair teams will be dispatched to set up the CFRS. At the termination of hostilities or after the pumping situation is completed, the CFRS must be drained, inventoried, consumed parts replaced, and equipment cleaned, operationally checked, serviced, and preserved.

Rapid recovery of jet fuel pumping resources are essential elements in maintaining a capability for air warfare. These storage and pumping resources are not expected to survive an attack or natural disaster without significant damage. The CFRS is designed to rapidly pump and distribute jet fuel and allow continued POL support for sustained aircraft operations.

PRE-OPERATIONAL PREPARATION PROCEDURES FOR CFRS.

SAFETY:

1. NUMEROUS PROCEDURES PRESENTED BELOW REQUIRE THE CONNECTING AND DISCONNECTING OF HOSES CONTAINING JP8 OR HYDRAULIC OIL. THESE PROCEDURES ALSO REQUIRE THE OPERATION OF PUMPING EQUIPMENT THAT MOVE THESE POTENTIALLY DANGEROUS FLUIDS.

2. ANY SPILLAGE RESULTING FROM THESE PROCEDURES, NO MATTER HOW INSIGNIFICANT THEY APPEAR, PRESENT A HAZARD TO PERSONNEL AND THE ENVIRONMENT.

3. ALL REASONABLE PRECAUTIONS SHALL BE TAKEN TO ELIMINATE OR MINIMIZE SPILLS. IN THOSE SITUATIONS WHERE SPILLS DO OCCUR, ALL REASONABLE ACTIONS SHALL BE TAKEN TO TRAP, COLLECT, AND DISPOSE OF ALL SPILLAGE. ALL REASONABLE PRECAUTIONS SHALL ALSO BE TAKEN TO PROTECT PERSONNEL ENGAGED IN THESE ACTIVITIES.

4. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY/DEATH AND SERIOUS DAMAGE TO THE ENVIRONMENT.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.

1.1. Refer to paragraph 4-2.

Step 2: Obtain POL System maps and drawings.

Step 3: Chock wheels and set hand brake on both the PFTU and FSU.

SAFETY:

1. THE PFTU ENGINE-STARTING BATTERY CONTAINS A HIGHLY CONCENTRATED SOLUTION OF SULFURIC ACID AS THE ELECTROLYTE.

2. ALL REASONABLE PRECAUTIONS SHALL BE TAKEN TO PREVENT SPILLAGE OF THE ELECTROLYTE FROM DROPPING OR TIPPING OF THE BATTERY.

3. IN THOSE SITUATIONS WHERE SPILLS DO OCCUR, ALL REASONABLE ACTIONS SHALL BE TAKEN TO NEUTRALIZE THE SPILLAGE WITH A SOLUTION OF WATER AND BAKING SODA.

4. ALL REASONABLE PRECAUTIONS SHALL ALSO BE TAKEN TO PROTECT PERSONNEL ENGAGED IN THESE ACTIVITIES WITH APPROPRIATE PROTECTIVE RUBBER CLOTHING.

5. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY.

Step 4: Obtain two fully-charged 12-volt engine-starting Gel-Cel or lead-acid batteries of sufficient capacity (normally 950 CCA or higher) to start the PFTU engine.

SAFETY:
OBSERVE CORRECT POLARITY WHEN CONNECTING THE ENGINE-STARTING BATTERY. CONNECT THE POSITIVE (+) CABLE FIRST. FAILURE TO COMPLY CAN RESULT IN SERIOUS PERSONNEL INJURY AND/OR DAMAGE TO EQUIPMENT.

Step 5: Install the batteries in battery compartment of PFTU and connect to engine electrical system.

Step 6: Install battery in battery compartment of FSU and connect to engine electrical system.

Step 7: Remove pintle hook from PFTU storage compartment and install into the bracket at the rear of the PFTU using ½" pintle locking pin. This allows tandem towing of PFTU and FSU.

Step 8: Inventory PFTU loose items, spares, and tools as per T.O. 37A13-5-1, Table 4-3, and FSU per T.O. 37A13-6-2, Table 4-1. Replace any missing or damaged items. Obtain all required consumables.

PRE-OPERATIONAL PROCEDURES FOR PFTU.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-2.2.1.

Step 2: Ensure bolts connecting hose-end collars on layflat hose connections are tight.

Step 3: Ensure serviceability of fire extinguisher.

Step 4: Check engine oil. Adjust level as required.

Step 5: Check engine belts for tightness and signs of deterioration. Adjust/replace as required.

Step 6: Check the presence and ensure the tightness of the following low-point drains.
6.1. Pump volute.
6.2. Suction, high-pressure, and low-pressure piping.

Step 7: Place the following valves in the CLOSED position.

- **7.1.** System inlet valve.
- **7.2.** Pump suction valve.
- **7.3.** Both filter/separator sampling ports.
- **7.4.** Low-pressure system valve.
- **7.5.** Low-pressure discharge valve.
- **7.6.** Hose Reel/Refueling valve.
- **7.7.** High-pressure discharge valve.
- **7.8.** ¾", spring-return expansion tank-to-pump suction ball valve. Ensure valve operates smoothly.
- **7.9.** ¾", spring-return expansion tank drain ball valve.
- **7.10.** ¾", spring-return expansion tank fill ball valve. Ensure valve operates smoothly.
- **7.11.** ¾", spring-return engine fuel tank fill ball valve. Ensure valve operates smoothly.
- **7.12.** ¾", spring-return filter/separator water sump drain valve. Ensure valve operates smoothly.
- **7.13.** ¾", spring-return filter/separator main drain ball valve. Ensure valve operates smoothly.
- **7.14.** ¾", spring-return strainer drain ball valve. Ensure valve operates smoothly.
- **7.15.** ¾", spring-return filter/separator vent ball valve. Ensure valve operates smoothly.

Step 8: Ensure the following caps/plugs are installed. If missing, clean port and install.

- **8.1.** Cart suction inlet camlock.
- **8.2.** Suction single-point receptacle.
- **8.3.** Strainer drain.
- **8.4.** Both filter/separator main drains.
- **8.5.** Both filter/separator main sampling ports.
- **8.6.** Expansion tank drain camlock.
- **8.7.** Low-pressure discharge camlock.
- **8.8.** High-pressure discharge camlock.
- **8.9.** Filter/separator air vent camlock.

Step 9: Verify filter/separator filter change due date IAW T.O. 37A-1-101.

Step 10: Ensure circuit breakers CB-2 and CB-3 on Master System Electric Panel are ON.

Step 11: Place Master Power switch on right side (facing) of Master System Electric Panel to ON.

Step 12: Place Control/Alarm Panel Power switch on left side (facing) of Control and Alarm Electric Panel to ON.

Step 13: Place pressure mode selector switch on Control and Alarm Electric Panel to HIGH.

Step 14: Place power. ON/OFF-RESET switch on left side (facing) of Control and Alarm Electric Panel to ON. High-pressure mode on indicator (red) will light.

Step 15: Place pressure mode selector switch on Control and Alarm Electric Panel to LOW.

Step 16: Place power ON/OFF-RESET switch to OFF-RESET and back to ON. Low-pressure mode indicator (green) will light.

Step 17: Depress Push-to-Test Alarms switch on Control and Alarm Electric Panel. Verify audible alarm sounds at front and back of PFTU and rotating amber beacon operates, then release switch.

Step 18: Place blackout switches on right side (facing) of Control and Alarm Electric Panel to BLACKOUT.

Step 19: Depress push-to-test alarms switch and verify amber light on side of panel lights, rotating amber beacon does not operate, then release switch..

Step 20: Place blackout switch to NORMAL.

Step 21: Test front and rear floodlights for proper operation.

Step 22: Release the refueling hose reel brake and unreel refueling hose and check for damage. Minor nicks, cuts, and scratches in the outer cover are acceptable. No damage to the inner cords is acceptable.

Step 23: Inspect end-couplers of refueling hose for slippage by checking that manufacturer's indicator band on rubber has not moved away from coupler.

Step 24: Rewind refueling hose using electric rewind motor. Set refueling hose reel brake.

Step 25: Wet fill PFTU.

25.1. Bond PFTU to R-9/II.
25.2. Connect R-9/I 1 single-point nozzle to PFTU aircraft coupler connection.
25.3. Replace the D-I single-point nozzle on refueling hose with automotive nozzle.
25.4. Verify PFTU is in low-pressure mode.
25.5. Coordinate with R-9/II operator to fill PFTU.

SAFETY:

FILL PFTU SLOWLY. PRESSURE FROM R-9/11 SHALL NOT EXCEED 20 PSI. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY OR DEATH.

NOTE:

Check for leaks throughout the fueling process.

25.6. Open pump suction valve.
25.7. Slowly fill PFTU until fuel flow stops. Initially throttle flow from R-9/1 1 with the system inlet butterfly valve.

Step 26: Fill PFTU engine fuel tank as follows:

NOTE:
Mater power switch on the system electric panel must be in the ON position for the deadman switch to operate. Pressure mode selector must be in LOW.

26.1 Open low-pressure system butterfly valve to allow fuel to flow to the refueling hose.
26.2. Open hose reel/refueling valve.
26.3. Unwind sufficient deadman switch cable to reach fuel tank.
26.4. Unwind sufficient refueling hose to reach fuel tank. Uncap fuel tank.
26.5. Squeeze deadman switch lever. Insert automotive nozzle into fuel tank and squeeze nozzle lever slowly to allow air in refueling hose to escape.
26.6. When tank is full, release automotive nozzle lever. Release deadman switch lever and cap fuel tank.

Step 27: Fill FSU engine fuel tank as follow:
27.1. Unwind sufficient deadman switch cable to reach fuel tank.
27.2. Unwind sufficient refueling hose to reach fuel tank. Uncap fuel tank.
27.3. Squeeze deadman switch lever. Insert automotive nozzle into fuel tank and squeeze nozzle lever slowly to allow air in refueling hose to escape.
27.4. When tank is full, release automotive nozzle lever. Release deadman switch lever and cap fuel tank.
27.5. Replace automotive nozzle with D-1 single-point nozzle and rewind refueling hose onto reel.
27.6. Rewind deadman switch cable and store deadman switch.
27.7. Close hose reel/refueling and low-pressure system valves.

Step 28: Disconnect R-9/11 hose from PFTU. Replace cover on aircraft fueling connection. Release R-9/11 operator.

SAFETY:
HEARING PROTECTION IS REQUIRED WITHIN 50 FEET OF AN OPERATING FSU/PFTU. FAILURE TO COMPLY CAN RESULT IN SERIOUS INJURY TO PERSONNEL.

Step 29: Start PFTU as follows:
29.1. Set main power switch on main electric panel to ON.
29.2. Set mode switch on Control and Alarm Electric Panel to LOW.

29.3. Set the engine power toggle switch on engine control panel to ON. Hold in the red override button (magnetic switch) and press the starter switch button. Release the starter switch button when the engine starts. Continue holding in red override button until oil pressure reaches approximately 32 psi.
29.4. Allow engine to warm up for approximately two minutes at 1000 rpm. Adjust engine speed to a smooth idle.
29.5. Engine operating indications after the warm-up period are shown in T.O. 37A13-5-1, Table 4-1.
29.6. Test emergency stop feature by pressing red mushroom-shaped emergency stop button.
29.7. Set the engine power toggle switch on engine control panel to OFF. Set main power switch on main electric panel to OFF.
29.8. Open low-pressure and high-pressure butterfly valves halfway.
29.9. Drain and plug suction inlet plumbing.

PRE-OPERATIONAL PROCEDURES FOR FSU.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-2.2.2.

NOTE:
When using this equipment in environmentally sensitive areas, a biodegradable vegetable oil (Mobile EAL224H) is recommended, in lieu of hydraulic fluid.

Step 2: Ensure engine crankcase and hydraulic reservoir drain plugs are in place and tight.

Step 3: Check engine oil. Add oil, if required. If the crankcase contains preservation oil, drain and refill with API Service CC/SE or CC/SF oil.

SAFETY:
ENSURE HYDRAULIC HOSES ARE NOT TWISTED AND THAT ALL QUICK-CONNECT COUPLERS ARE TIGHTENED SECURELY. IF ANY HOSE TURNS ON ITS CONNECTOR, IT IS TOO LOOSE. FAILURE TO COMPLY WILL CAUSE DAMAGE TO THE PUMP.

Step 4: Remove submersible pump from FSU and place in a convenient location.

Step 5: Release the reel brake and unwind the hydraulic hoses to the submersible pump. Examine each hose for fraying, cuts, scrapes, or other signs of physical wear.

Step 6: Verify that hose reel swivel seal turns freely at both ends of reel.

SAFETY:
TIGHTEN CONNECTIONS UNTIL HOSE QUICK-CONNECTS ARE LOCKED. FAILURE TO COMPLY MAY CAUSE DAMAGE TO EQUIPMENT OR SERIOUS INJURY TO PERSONNEL.

Step 7: Attach the hydraulic hoses from the hydraulic hose reel assembly to the submersible pump. Ensure all connections are clean before mating.

Step 8: Unwind emergency stop button cable from reel and position emergency stop button near submersible pump. Examine cable for nicks, cracks, and/or insulation breakdown. Determine usability/reliability of cable.

Step 9: Turn supply bypass valve on FSU control panel counterclockwise until handle rotates freely. This will de-energize the hydraulic system to permit easy starting of the engine. It also allows the pumping action to be shut down (bypassed/deadhead) without stopping the engine.

SAFETY:
ENSURE CAMLOCK CAP AND PLUG ARE IN PLACE TO PREVENT FOREIGN MATTER ENTERING THE PUMP. FAILURE TO COMPLY WILL RESULT IN DAMAGE TO THE EQUIPMENT.

Step 10: Place the submersible pump on its side and away from the power unit and stabilize for a dry-test on land.

SAFETY:
DO NOT START THE ENGINE IF FUEL SPILLAGE IS PRESENT. ARCING AT THE STARTER MOTOR CAN IGNITE EXPLOSIVE FUEL/VAPORS. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY/DEATH.

Step 11: Start FSU diesel engine using the following procedures:

NOTE:
DO NOT remove the starter key from the attaching lanyard.

11.1. Ensure supply bypass valve is open and the circuit breaker is pushed in.
11.2. Set the key switch to ON and verify all lamps test.
11.3. Check hydraulic fluid level on gage. Fill to 3/4 tank, if required.
11.4. Rotate key switch to START until engine starts.
11.5. Adjust throttle for 1800 rpm and verify oil pressure lamp goes out.
11.6. Allow engine to warm up for approximately two minutes at 1800 rpm. Adjust engine speed to a smooth idle.

11.7. Engine operating indications after the warm-up period are shown in T.O. 37A13-5-1, Table 4-2.
11.8. Test emergency stop feature by pressing red mushroom-shaped emergency stop button.
11.9. Restart diesel engine. Adjust engine throttle to obtain 2450 rpm.

SAFETY:
DO NOT OPERATE THE SUBMERSIBLE PUMP OVER 2 MINUTES DURING DRY-TEST. FAILURE TO COMPLY WILL RESULT IN DAMAGE TO THE SUBMERSIBLE PUMP.

Step 12: Turn supply bypass valve clockwise slightly until pump operates. DO NOT exceed 2250 psi.

Step 13: Check submersible pump for operation.

Step 14: Turn supply bypass valve counterclockwise to de-energize hydraulic system and stop the submersible pump.

Step 15: Decrease engine speed to approximately 1500 rpm and set key switch to OFF.

Step 16: Disconnect hydraulic hoses from submersible pump. Take all precautions to control spillage of hydraulic oil. Install the windlass handle and rewind the hydraulic hoses on the reel. Set the reel brake.

Step 17: Rewind the emergency stop cable.

Step 18: Store the submersible pump on FSU.

Step 19: Connect PFTU to tow vehicle. Connect FSU to tow vehicle.

NOTE:
During equipment checkout, common hardware (i.e., nuts, bolts, and screws) shall be checked for security and tightness, as required.

Step 20: Obtain replacement components for any missing or unserviceable items.

Step 21: Disperse CFRS as directed.

Pump Site Preparation and Equipment Setup.

If above ground pumping is required, site preparation must be accomplished before pumping can commence. The following procedures are for initial work site preparation and equipment set-up when pumping from an underground sources. These procedures assume the tie-in point on the tank is damaged or is not accessible.

PROCEDURES FOR DETERMINING PUMPING SITE PREPARATION REQUIREMENTS.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.4.1.

SAFETY:
HOSES PRESENT TRIPPING HAZARDS. FAILURE TO EXERCISE CAUTION COULD CAUSE SERIOUS PERSONNEL INJURY.

Step 2: Determine pumping site entry/exit route and location for FSU and PFTU.

Step 3: Determine requirements for earth/debris moving equipment.

Step 4: De-energize any active cathodic protection system(s) installed on the fuel system.

PROCEDURES FOR POSITIONING FSU AND PFTU.

To perform this task, follow these steps:

SAFETY:
EQUIPMENT AND TOOLS MUST BE POSITIONED TO ALLOW UNIMPEDED PUMPING SITE ACCESS/EGRESS IN AN EMERGENCY AND POSITION OPERATING ENGINES AT A SAFE DISTANCE FROM ANY EXPLOSIVE VAPORS. FAILURE TO DO SO COULD RESULT IN SERIOUS PERSONNEL INJURY.

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.4.2.

Step 2: Position PFTU at least 50 feet from and upwind of the manhole. Chock wheels and set brakes of PFTU to ensure stability of the cart.

Step 3: Position FSU at least 50 feet, but no farther than 140 feet, from and upwind of the manhole and as close to the PFTU as possible (maximum distance 75 feet) to allow for bonding connection and fueling operations. Chock wheels and set brakes of FSU to ensure stability of the cart.

Step 4: Establish a linear electrical bond between FSU, PFTU, and fuel tank.

PROCEDURES FOR FSU SET-UP.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.4.3.

Step 2: Remove submersible pump from FSU, fuel transfer hoses and tripod/winch assembly from PFTU, and position near manhole.

Step 3: If vapor concentrations dictate, procure vaneaxial fan and air compressor and associated equipment from POL RURK I.

Step 4: Unreel hydraulic supply/return hose assemblies from hose reel assembly and lay alongside submersible pump.

Step 5: Unreel emergency stop cable and position at the PFTU.

PROCEDURES FOR PFTU SET-UP.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.4.4.

Step 2: Mark traffic pattern for fuel trucks entering and leaving the fueling area.

Step 3: Unreel sufficient length of 2-1/2" refueling hose from refueling hose reel and position the nozzle in a protected spot. Use pipe stand from POL RURK I if necessary to protect nozzle.

SAFETY:
NEVER USE HOSE WITH BANDED CAMLOCK COUPLINGS IN THE HIGH-PRESSURE DISCHARGE. NEITHER THE HOSE NOR THE COUPLER IS COMPATIBLE WITH THE HIGH DISCHARGE PRESSURE OF THE PFTU. FAILURE TO COMPLY CAN RESULT IN SERIOUS PERSONNEL INJURY OR DEATH.

NOTE:
Compatibility with 6" diameter POL RURK I hard wall and layflat hose sections, as well as butterfly valves, elbows, and crosses are a design feature of this system. See TO 35D26-9-2-1 for installation instructions using Victaulic snap-clamps.

Step 4: Replace all camlock gaskets in all hoses and adapters prior to use.

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Step 5: Lay out required number of fuel transfer hoses to reach high-pressure destination. Use combination of 3" camlock hard wall hoses, 3" lay flat hoses, and POL RURK I components.

> **NOTE:**
> *For more distance, use camlock-to-Victaulic adapter to enter POL RURK I 6-inch line and reverse to return to CFRS pipeline hoses. Two sets of adapters are provided which allows a total of two entries and exits.*
>
> *For more valves, use POL RURK I butterfly valves where hose ends will be isolated during breakdown.*

Step 6: Select the appropriate hose adapter(s) to mate to destination fitting. At least one hardwall hose section at the destination fitting and at the PFTU discharge is required.

Step 7: Open the destination pipeline cover and mount the hose adapter at the destination fitting.

Step 8: Connect the ball valve drybreak to the appropriate discharge fitting of the PFTU.

Step 9: Connect all hoses starting at the PFTU discharge and continuing to the destination fitting. Male camlock adapters on the discharge side of the PFTU are to be oriented toward the destination fitting.

Step 10: Remove all kinks or excessive bends in the layflat hoses prior to transferring fuel. Remove any debris or sharp edges which may damage the hose.

Step 11: Connect a portable bonding cable between the PFTU discharge and destination fittings.

PROCEDURES FOR PFTU-TO-FSU INTERFACE.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.4.5.

Step 2: Replace all cam lock gaskets on all hoses and adapters prior to use.

Step 3: Connect bonding cable from the PFTU to the FSU using the installed 75-ft bonding reel. The bonding arrangement is shown in Figure 18.

Step 4: Connect one ball valve drybreak and at least one section of hard wall hose to the PFTU suction inlet.

> **NOTE:**
> Lay flat fuel transfer hose can be used to feed PFTU suction inlet since FSU will pressurize the line.

Step 5: Connect the required number of fuel transfer hoses from the submersible pump to the suction side of the PFTU. Allow a sufficient number of hard wall hose sections connected to submersible pump to reach to bottom of the tank. Use a combination of 3-inch and RURK I components to reach the distance.

PROCEDURES FOR PUMPING FROM AN ABOVEGROUND CUT-AND-COVER TANK.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
- Refer to paragraph 4-3.5.

Step 2: Determine fuel-scavenging components needed. Refer to T.O. 37A13-5-1, Table 4-3.

Step 3: Locate and expose the tank manhole.

Step 4: Remove bolts from manhole cover, establish electrical bond.

SAFETY:
AN OPEN MANHOLE COVER POSES A RISK IF FALLEN INTO. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY OR DEATH.

NOTE:
Bolts may be cut with hacksaw if badly corroded. The tripod/winch assembly may be used to assist in lifting the manhole cover, if necessary.

Step 5: Set up tripod/winch assembly over manhole opening and remove manhole cover. Connect 10-ft bonding cable between tripod and tank.

Step 6: Connect the fixed bonding cable from the FSU to the tank. The bonding arrangement is shown in Figure 18.

Step 7: Gauge tank with water-finding paste to determine depth to set pump. Setup submersible pump above tank.

Step 8: Replace all camlock gaskets in all hoses and adapters prior to use.

Step 9: For deep tank operation greater than forty feet, thread a loop of bonding wire cable around pump discharge fitting and through lifting bail. Attach winch cable to the loop or lifting bail of the submersible pump.

Step 10: Connect one 10-foot length of hard wall hose and the hydraulic supply/return hoses to the submersible pump.

Step 11: Lower the submersible pump and attached hoses into the tank. Pump height is 18 to 20 inches from the bottom of the screen to the discharge hose connection. Attach additional lengths of hard wall hose to the first as necessary. Lower submersible pump and attached hoses into the tank to the proper depth.

SAFETY:
THE WINCH IS A GENERAL PURPOSE WINCH AND THE LOAD RATING IS BASED ON AN INTERMITTENT DUTY CYCLE. THE WINCH IS NOT DESIGNED TO BE A HUMAN HOIST AND SHOULD NOT BE OPERATED WHEN THERE ARE PERSONS POSITIONED ON OR UNDER THE LOAD BEING LIFTED. THE WINCH BRAKE IS DESIGNED TO HOLD THE LOAD WHENEVER THE HANDLE IS RELEASED. THE TRIPOD/WINCH ASSEMBLY MUST BE PLACED ON A FLAT SURFACE AND SECURED IF NECESSARY TO ELIMINATE THE POSSIBILITY OF TIPPING OVER. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY OR DEATH.

NOTE:
Ensure the cable is pulling straight off the winch, not at an angle. This will prevent the cable from rubbing against the side of the outer protective covering.

Ensure the submersible pump is hanging straight off the winch and is hanging vertical/straight inside the fuel tank. This will prevent entrapped air and cavitation.

Never use worn, frayed, or kinked cable. When any of these conditions exist, replace the cable. Failure to comply can result in equipment damage.

Ensure the cable length is adequate to maintain at least three complete wraps around the drum when under load. Failure to comply can result in equipment damage.

Step 12: Interface the PFTU to the FSU as per procedures in this AFQTP.

PROCEDURES FOR PUMPING FROM AN UNDERGROUND TANK.

NOTE:
Following are procedures for using the FSU to pump from an underground source. Underground tanks generally have some type of structure built over the manhole cover. This structure poses complications in that the working space is limited and possibility of collecting explosive vapors when the manhole is lifted is increased. Additional equipment from the POL RURK I may be required to evacuate explosive vapors and maintain a safe LEL for fuel scavenging from an underground tank.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.6.

Step 2: Determine fuel transfer components needed. Refer to T.O. 37A13-5-1, Table 4-3.

Step 3: Check for safe fuel vapor and oxygen levels.

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

Step 4: Locate and expose the buried tank manhole cover.

Step 5: If required, set-up vaneaxial fan to evacuate fuel vapor concentrations.

Step 6: Remove bolts from manhole cover, establish electrical bond.

SAFETY:
AN OPEN MANHOLE COVER POSES A RISK IF FALLEN INTO. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY OR DEATH.

NOTE:
Bolts may be cut with hacksaw if badly corroded. The tripod/winch assembly may be used to assist in lifting the manhole cover, if necessary.

Step 7: Set up tripod/winch assembly over manhole opening and remove manhole cover. Connect 10-ft bonding cable between tripod and tank.

Step 8: Connect the fixed bonding cable from the FSU to the tank. The bonding arrangement is shown in Figure 18.

Step 9: Gauge tank with water-finding paste to determine depth to set pump. Setup submersible pump above tank.

Step 10: Replace all camlock gaskets in all hoses and adapters prior to use.

Step 11: For deep tank operation greater than forty feet, thread a loop of bonding wire cable around pump discharge fitting and through lifting bail. Attach winch cable to the loop or lifting bail of the submersible pump.

Step 12: Connect one 10-foot length of hard wall hose and the hydraulic supply/return hoses to the submersible pump.

Step 13: Lower the submersible pump and attached hoses into the tank. Pump height is 18 to 20 inches from the bottom of the screen to the discharge hose connection. Attach additional lengths of hard wall hose to the first as necessary. Lower submersible pump and attached hoses into the tank to the proper depth.

SAFETY:
THE WINCH IS A GENERAL PURPOSE WINCH AND THE LOAD RATING IS BASED ON AN INTERMITTENT DUTY CYCLE. THE WINCH IS NOT DESIGNED TO BE A HUMAN HOIST AND SHOULD NOT BE OPERATED WHEN THERE ARE PERSONS POSITIONED ON OR UNDER THE LOAD BEING LIFTED. THE WINCH BRAKE IS DESIGNED TO HOLD THE LOAD WHENEVER THE HANDLE IS RELEASED. THE TRIPOD/WINCH ASSEMBLY MUST BE PLACED ON A FLAT SURFACE AND SECURED IF NECESSARY TO ELIMINATE THE POSSIBILITY OF TIPPING OVER. FAILURE TO COMPLY CAN RESULT IN PERSONNEL INJURY OR DEATH.

NOTE:
Ensure the cable is pulling straight off the winch, not at an angle. This will prevent the cable from rubbing against the side of the outer protective covering.

Ensure the submersible pump is hanging straight off the winch and is hanging vertical/straight inside the fuel tank. This will prevent entrapped air and cavitation.

Never use worn, frayed, or kinked cable. When any of these conditions exist, replace the cable. Failure to comply can result in equipment damage.

Ensure the cable length is adequate to maintain at least three complete wraps around the drum when under load. Failure to comply can result in equipment damage.

Step 14: Interface the PFTU to the FSU as per procedures in this AFQTP.

PROCEDURES FOR PUMPING FROM THE TIE-POINT OF AN ABOVEGROUND TANK.

NOTE:
The FSU is not required during this evolution.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
- Refer to paragraph 4-3.7.

Step 2: Determine fuel transfer components needed. Refer to T.O. 37A13-5-1, Table 4-3.

Step 3: Replace all camlock gaskets in all hoses and adapters prior to use.

Step 4: Attach the appropriate number of hardwall hoses to the tie-point of the aboveground tank.

Step 5: Attach the other end of the hardwall hoses to the inlet of the PFTU.

PROCEDURES FOR FSU OPERATION.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.8.

Step 2: Position the emergency stop button of the FSU near the PFTU to facilitate emergency stop actions.

Step 3: Turn the supply bypass valve on the FSU control panel counterclockwise until the handle rotates freely. This will de-energize the hydraulic system to permit easy starting of the engine. The valve also allows the submersible pump to be shut down without stopping the engine.

Step 4: Start the FSU engine as follows:

> **NOTE:**
> ***DO NOT*** *remove the starter key from the attaching lanyard.*

4.1. Ensure supply bypass valve is open and the circuit breaker is pushed in.
4.2. Set the key switch to ON and verify all lamps test.
4.3. Check hydraulic fluid level on gage. Fill to 3/4 talk, if required.
4.4. Rotate key switch to START until engine starts, then release.
4.5. Adjust throttle for 1800 rpm and verify oil pressure lamp goes out.
4.6. Allow engine to warm up for approximately two minute at 1800 rpm. Adjust engine speed to a smooth idle.
4.7. Adjust engine throttle to 2450 rpm.

Step 5: Turn the supply bypass valve on FSU clockwise until pressure gage reads 1000 psi.

Step 6: Open PFTU system inlet drybreak ball valve.

Step 7: Open the PFTU pump suction butterfly valve.

Step 8: Open the PFTU system inlet butterfly valve to second detent until all air is eliminated from the system. Then, open fully.

Step 9: Verify that suction pressure gage on PFTU registers a positive pressure. Adjust supply bypass valve on the FSU until pump suction vacuum level reads approximately + 35 to + 40 psi.

Fuel Transfer Operations With FSU.

During operations with the FSU, the following items should be periodically monitored.

1. Monitor the fuel level in the expansion tank. If the tank requires draining while actively pumping, induce a negative suction pressure by adjusting the supply bypass valve on the FSU or throttling flow at the PFTU suction by using the PFTU throttle.

2. Once suction on the expansion tank is established, open the expansion tank drain valve between the PFTU suction line and the expansion tank.

3. Once the expansion tank is drained, release the spring-return valve between the PFTU suction line and the expansion tank. The expansion tank can also be drained into a bucket under any pumping conditions.

4. Monitor engine fuel tank sight gage. Refill as needed. To fuel the unit while pumping, proceed as follows.

NOTE:
DO NOT *overfill the expansion tank. The high-level switch will shut down the engine.*

a. Induce fuel into the expansion tank by holding the spring-return expansion tank fill valve open while monitoring the fuel level in the sight gage. Once the expansion tank is filled, release the fill valve.

b. Open the spring-return engine fuel tank fill valve and monitor the fuel tank sight gage. Venting of the fuel tank can be achieved by loosening the fill cap on the engine fuel tank. Once the fuel tank is filled, or expansion tank is empty, release the engine fuel tank fill valve.

c. Monitor the filter/separator differential pressure. Replace filters when differential pressure reaches 15 psi.

d. Monitor all gages on the FSU and PFTU for safe operation.

PROCEDURES FOR FUEL LOW-PRESSURE TRANSFER OPERATION WITH FSU.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.9.1.

Step 2: Set PFTU main power switch to ON.

Step 3: Ensure the high-pressure discharge, low-pressure discharge, low-pressure system, and hose reel refueling butterfly valves are closed.

Step 4: Ensure no kinks or obstructions exist in the layflat hoses.

Step 5: Set ON/OFF-RESET switch on left side (facing) of Control and Alarm Electric Panel to OFF-RESET. Set pressure mode select switch to LOW. Set ON/OFF-RESET switch to ON. Verify low-pressure mode indicator light (green) illuminates.

Step 6: Ensure the FSU is operating and the submersible pump is providing a positive pressure at the PFTU. Also, ensure the PFTU system inlet and pump suction valves are open.

Step 7: Start the PFTU engine as follows:

7.1. Set engine control panel toggle switch to ON.
7.2. Ensure engine throttle is set to IDLE.
7.3. Hold in the red override button (magnetic switch) and press the starter button.
7.4. Release the starter button when the engine starts. Continue holding in the red override button until oil pressure is maintained (5 to 10 seconds), then release.
7.5. From a cold start, allow the engine to warm up for approximately two minutes at 1400-1600 rpm.

NOTE:
Establish communications between all fuel transfer participants to maintain proper fuel transfer procedures.

Step 8: Move low-pressure butterfly valve to OPEN.

Step 9: Open either the hose reel/refueling butterfly valve or low pressure discharge and dry break ball valve. Ensure the other valves remain closed. If the 2-1/2 inch hose with single-point nozzle is used, the nozzle valve must be open.

Step 10: Monitor all hoses and connections as fuel transfer is initiated. Repair leaks as necessary.

Step 11: Maintain PFTU at idle until fuel transfer is required.

SAFETY:
WHEN THE DEADMAN SWITCH IS ACTIVATED, FUEL FLOW WILL BE ESTABLISHED THROUGHOUT THE SYSTEM. ENSURE ALL CONNECTIONS ARE MADE AND ALL HOSES ARE CONNECTED. FAILURE TO COMPLY CAN RESULT IN SERIOUS PERSONNEL INJURY.

Step 12: Squeeze the deadman handle to energize the deadman control and start the pumping operation.

Step 13: When fuel transfer is required, increase engine rpm not to exceed 2200 rpm.

NOTE:

Operating the PFTU in deadhead at high power settings will heat fuel in the pump volute. Be prepared to retard throttle. See Fuel Temperature Warning Response Procedures later in this AFQTP.

When advancing the PFTU throttle no longer decreases suction pressure, maximum fuel flow is established. ***DO NOT*** *exceed 2200 rpm.*

When increasing FSU hydraulic pressure no longer increases suction pressure, maximum fuel flow is established. ***DO NOT*** *exceed 2250 psi.*

Step 14: Monitor pump suction/vacuum gage to maintain a positive inlet pressure during fuel transfer operations. Adjust throttle on PFTU for maximum fuel flow. As fuel flow decreases, the suction pressure will increase.

Step 15: During prolonged, but intermittent, fuel transfer operations, the hydraulic bypass valve on the FSU should be opened.

Step 16: During fuel transfer operations, monitor system gages to maintain safe pumping operations.

PROCEDURES FOR FUEL HIGH-PRESSURE TRANSFER OPERATION WITH FSU.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.9.2.

Step 2: Set master power switch on PFTU to ON.

Step 3: Ensure the high-pressure discharge, low-pressure discharge, low-pressure system, and hose reel/refueling butterfly valves are closed.

Step 4: Ensure no kinks or obstructions exist in the layflat hoses.

Step 5: Set ON/OFF-RESET switch on left side (facing) of Control and Alarm Electric Panel to OFF-RESET. Set pressure mode select switch to HIGH. Set ON/OFF-RESET switch to ON. Verify high-pressure mode light (red) illuminates.

Step 6: Ensure the FSU is operating and the submersible pump is providing a positive pressure at the PFTU. Also, ensure the system inlet and pump suction valves are open.

SAFETY:
WHEN THE HIGH-PRESSURE DISCHARGE VALVE IS OPENED, FUEL FLOW WILL BE ESTABLISHED THROUGHOUT THE SYSTEM. ENSURE ALL CONNECTIONS ARE MADE AND ALL HOSES ARE CONNECTED. FAILURE TO COMPLY CAN RESULT IN SERIOUS PERSONNEL INJURY.

Step 7: Start the PFTU engine as follows:
- **7.1.** Set engine control panel toggle switch to ON.
- **7.2.** Ensure engine throttle is set to IDLE.
- **7.3.** Hold in the red override button (magnetic switch) and press the starter button.
- **7.4.** Release the starter button when the engine starts. Continue holding in the red override button until oil pressure is maintained (5 to 10 seconds), then release.
- **7.5.** From a cold start, allow the engine to warm up for approximately two minutes at 1400-1600 rpm.

Step 8: Open drybreak ball valve at high-pressure discharge.

Step 9: Open high-pressure discharge butterfly valve.

Step 10: Monitor all hoses and connections as fuel transfer is initiated. Ensure no kinks or obstructions exist in the layflat hoses. Repair leaks as necessary.

NOTE:
Establish communications between all fuel transfer participants to maintain proper fuel transfer procedures.

Step 11: Maintain PFTU at idle until fuel transfer is required.

Step 12: When fuel transfer is required, increase engine rpm to meet fuel transfer demands, but not to exceed 2800 rpm.

NOTE:
Operating the PFTU in deadhead at high power setting will heat fuel in the pump volute. Be prepared to retard throttle. See Fuel Temperature Warning Response Procedures later in this AFQTP. Deadhead operation in high-pressure mode with the bypass control valve open will yield approximately 5 to 6 minutes of operating time before the fuel high temperature warning sounds. Fuel temperature will trigger shutdown approximately 2 minutes later.

When advancing the PFTU throttle no longer decreases suction pressure, maximum fuel flow is established. ***DO NOT*** *exceed 2200 rpm.*

When increasing FSU hydraulic pressure no longer increases suction pressure, maximum fuel flow is established. ***DO NOT*** *exceed 2250 psi.*

Step 13: Monitor pump suction/vacuum gage to maintain a positive inlet pressure during fuel transfer operations. Adjust throttle on PFTU for maximum fuel flow. As fuel flow decreases, the suction pressure will increase.

Step 14: During prolonged, but intermittent, fuel transfer operations, the hydraulic bypass valve on the FSU should be opened.

Step 15: During fuel transfer operations, monitor system gages to maintain safe pumping operations (100-150 psi at high-pressure discharge and –5 Hg (suction) to 20 psi at pump suction).

Changing Pumping Modes.

The following are procedures for changing pumping modes.

PROCEDURES FOR CHANGING PUMPING MODES FROM HIGH-PRESSURE TO LOW PRESSURE.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.10.1.

Step 2: Return PFTU throttle to idle.

Step 3: Ensure the high-pressure discharge, low-pressure system, low-pressure discharge, and hose reel/refueling butterfly valves are closed.

Step 4: Set mode selector switch to LOW.

Step 5: Set ON/OFF-RESET switch on Control and Alarm Electrical Panel to OFF-RESET and back to ON. Ensure the low-pressure mode light (green) illuminates.

Step 6: Open low-pressure system butterfly valve.

Step 7: Open appropriate low-pressure butterfly valve.

Step 8: Continue pumping operations as outline in low-pressure operations procedures.

Step 9: Ensure the low-pressure discharge gage is reading a positive pressure.

PROCEDURES FOR CHANGING PUMPING MODES FROM LOW-PRESSURE TO HIGH PRESSURE.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.10.2.

Step 2: Return PFTU throttle to idle.

SAFETY:
DO NOT OPEN LOW-PRESSURE SYSTEM VALVE WHILE OPERATING IN HIGH-PRESSURE MODE. FAILURE TO COMPLY COULD CAUSE DAMAGE TO EQUIPMENT OR SERIOUS INJURY TO PERSONNEL.

Step 3: Ensure the high-pressure discharge, low-pressure system, and hose reel/refueling butterfly valves are closed.

Step 4: Set mode selector switch to HIGH.

Step 5: Set ON/OFF-RESET switch on Control and Alarm Electrical Panel to OFF-RESET and back to ON. Ensure the high-pressure mode light (red) illuminates.

Step 6: Open high-pressure system discharge butterfly valve. Also, ensure the high-pressure discharge gage is reading a positive pressure.

Step 7: Continue pumping operations as outline in high-pressure operations procedures.

Step 8: Ensure the high-pressure discharge gage is reading a positive pressure.

Fuel Transfer Operation Without the FSU.

To perform this task you will need to slow-fill the PFTU piping. (See pre-operational procedures for PFTU.) Also, during operations without the FSU, the following items should be periodically monitored.

1. Monitor the fuel level in the expansion tank. If the tank requires draining while actively pumping, open the spring-return ball valve between the PFTU suction line and the expansion tank. Once the expansion tank is drained, release the spring-return valve between the PFTU suction line and the expansion tank.
   The expansion tank can also be drained into a bucket under any pumping conditions.

2. Monitor engine fuel tank sight gage. Refill as needed. To fuel the unit while pumping, proceed as follows.

NOTE:
DO NOT *overfill the expansion tank. The high-level switch will shut down the engine.*

   a. Induce fuel into the expansion tank by holding the spring-return expansion tank fill valve open while monitoring the fuel level in the sight gage. Once the expansion tank is filled, release the fill valve.

b. Open the spring-return engine fuel tank fill valve and monitor the fuel tank sight gage. Venting of the fuel tank can be achieved by loosening the fill cap on the engine fuel tank. Once the fuel tank is filled, or expansion tank is empty, release the engine fuel tank fill valve.

c. Monitor the filter/separator differential pressure. Replace filters when differential pressure reaches 15 psi.

d. Rate of fuel flow will be limited through 3-inch suction hoses. Performance can be increased if 4-inch non-collapsible suction hose is used between flooded source and PFTU suction inlet. Use 4-inch female-to-3-inch male camlock adapter on the PFTU suction inlet.

PROCEDURES FOR FUEL LOW-PRESSURE TRANSFER OPERATION WITHOUT THE FSU.

To perform this task, follow these steps:

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.11.1.

Step 2: Set PFTU main power switch on master electric panel to ON.

Step 3: Set ON/OFF-RESET switch on left side (facing) of Control and Alarm Electric Panel to OFF-RESET. Set pressure mode select switch to LOW. Set ON/OFF-RESET switch to ON. Verify low-pressure mode indicator light (green) illuminates.

Step 4: Monitor all hoses and connections as fuel transfer is initiated. Ensure no kinks or obstructions exist in the layflat hoses. Repair leaks as necessary.

Step 5: Open hose reel/refueling butterfly valve. Ensure the non-selected valve is closed. Open low-pressure discharge butterfly valve. If the 2-1/2-inch hose with single-point nozzle is used, the nozzle valve must be open.

Step 6: Start the PFTU engine as follows:
6.1. Set engine control panel toggle switch to ON.
6.2. Ensure engine throttle is set to IDLE.
6.3. Hold in the red override button (magnetic switch) and press the starter button.
6.4. Release the starter button when the engine starts. Continue holding in the red override button until oil pressure is Maintained (5 to 10 seconds), then release.
6.5. From a cold start, allow the engine to warm up for approximately two minutes at 1400-1600 rpm.

NOTE:
Establish communications between all fuel transfer participants to maintain proper fuel transfer procedures.

Step 7: Maintain PFTU at idle until fuel transfer is required.

SAFETY:
WHEN THE DEADMAN SWITCH IS ACTIVATED, FUEL FLOW WILL BE ESTABLISHED THROUGHOUT THE SYSTEM. ENSURE ALL CONNECTIONS ARE MADE AND ALL HOSES ARE CONNECTED. FAILURE TO COMPLY CAN RESULT IN SERIOUS PERSONNEL INJURY.

NOTE:
Operating the PFTU in deadhead at high power setting will heat fuel in the pump volute. Be prepared to retard throttle.

Step 8: When fuel transfer is required, increase engine rpm not to exceed 2200 rpm and squeeze deadman handle.

Step 9: Monitor pump inlet pressure/vacuum gage to maintain a maximum inlet vacuum of 12 Hg during fuel transfer operations.

Step 10: During fuel transfer operations, monitor system gages to maintain safe pumping operations.

Shutdown Procedures.

The following are emergency and normal shutdown procedures for the FSU and PTFU.

PROCEDURES FOR EMERGENCY SHUTDOWN OF THE FSU AND PFTU.

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.12.1.

Step 2: Press PFTU emergency shutdown button at the rear of the PFTU or set the PFTU engine control start *ON/OFF* switch to OFF.

Step 3: Press FSU emergency stop button.

PROCEDURES FOR NORMAL SHUTDOWN OF THE FSU AND PFTU.

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.12.2.

Step 2: Throttle PFTU engine to idle.

Step 3: Release deadman if in the low-pressure mode.

Step 4: Close all open discharge butterfly valves. Do not close either drybreak ball valve or PFTU inlet butterfly valve due to potential thermal expansion.

Step 5: Set PFTU engine control start ON/OFF switch to OFF.

Step 6: Turn the supply bypass valve on the FSU counterclockwise until handle rotates freely to de-energize the hydraulic system.

Step 7: Throttle FSU engine to idle.

Step 8: Set the FSU key switch to OFF.

Step 9: Turn Master Disconnect switches on Master Electric Panel to OFF.

Fuel Temperature Warning Response Procedures.

A fuel temperature warning condition occurs when the pump is running against a deadhead condition. The fuel moves through the bypass valve and back into the pump causing the fuel to continuously heat. The following are the procedures you need to know to respond to this condition.

PROCEDURES FOR FUEL TEMPERATURE WARNING RESPONSE .

Step 1: Locate T.O. 37A13-5-1, Organizational and Maintenance Instructions CFRS.
1.1. Refer to paragraph 4-3.13.

Step 2: Immediately return PFTU throttle to idle.

Step 3: If the cause of the deadhead condition is unknown, immediately place engine Control Panel Start ON/OFF switch to OFF.

Step 4: Turn the supply bypass valve on the FSU counterclockwise until handle rotates freely to de-energize the hydraulic system.

Step 5: Determine cause of no-flow condition.

Step 6: If no-flow condition is not immediately correctable, press FSU engine Emergency STOP button.

Upon completion of the above information see your Unit Education and Training Manager to take the following <u>mandatory</u> CerTest to meet the minimum upgrade requirement for Diamond tasks.

Test #	**Title**
8221	**CFRS AFQTP, Test One**
8222	**CFRS AFQTP, Test Two**
8223	**CFRS AFQTP, Test Three**

If equipment is available, complete these tasks for hands-on certification training.

OPERATE/MAINTAIN CONTINGENCY FUEL RECOVERY SYSTEM (CFRS)

Performance Checklist used by the Trainer/Certifier		
Step	**Yes**	**No**
Pre-operational Preparation Procedures for CFRS.		
1. Did trainee obtain T.O. 37A13-5-1 for pre-operational inspection?		
2. Did trainee chock wheels and set hand brake on the PFTU and FSU?		
3. Did trainee obtain and install batteries into the PFTU and FSU?		
4. Did trainee install pintle hook for tandem towing?		
5. Did trainee perform an inventory IAW T.O. 37A13-5-1, Table 4-3, for PFTU and IAW 37A13-6-2, Table 4-1, for FSU?		
Step	**Yes**	**No**
Pre-operational Procedures for PFTU.		
1. Did trainee know and follow the pre-operational procedures for the PFTU? **Trainer Note:** Utilize steps on page 70 to assess trainee knowledge.		
Step	**Yes**	**No**
Pre-operational Procedures for FSU.		
1. Did trainee know and follow the pre-operational procedures for the FSU? **Trainer Note:** Utilize steps on page 74 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Determining Pumping Site Preparation Requirements.		
1. Can trainee determine pump site preparation requirements? **Trainer Note:** Utilize steps on page 77 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Positioning FSU and PFTU.		
1. Can trainee perform the procedures for positioning the FSU and PFTU? **Trainer Note:** Utilize steps on page 77 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for FSU Set-up.		
1. Can trainee perform the procedures for FSU set-up? **Trainer Note:** Utilize steps on page 78 to assess trainee knowledge.		
Step	**Yes**	**No**
PROCEDURES FOR PFTU SET-UP.		
1. Can trainee perform the procedures for PFTU set-up? **Trainer Note:** Utilize steps on page 78 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for PFTU-to-FSU Interface.		
1. Can trainee perform the procedures for PFTU-to-FSU interface ? **Trainer Note:** Utilize steps on page 79 to assess trainee knowledge.		

Performance Checklist used by the Trainer/Certifier (Cont.)		
Step	**Yes**	**No**
PROCEDURES FOR PUMPING FROM AN ABOVEGROUND CUT-AND-COVER TANK.		
1. Can trainee perform the procedures for pumping from a cut-and-cover tank? **Trainer Note:** Utilize steps on page 80 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Pumping from an Underground Tank.		
1. Can trainee perform the procedures for pumping from an underground tank? **Trainer Note:** Utilize steps on page 81 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Pumping from the connection point of an Aboveground Tank.		
1. Can trainee perform the procedures for pumping from the connection point of an aboveground tank? **Trainer Note:** Utilize steps on page 83 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for FSU Operation.		
1. Can trainee perform the procedures for operation of the FSU? **Trainer Note:** Utilize steps on page 83 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Fuel Low-Pressure Transfer Operation with FSU.		
1. Can trainee perform the procedures for fuel low-pressure transfer with the FSU? **Trainer Note:** Utilize steps on page 85 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Fuel High-Pressure Transfer Operation with FSU.		
1. Can trainee perform the procedures for fuel high-pressure transfer with the FSU? **Trainer Note:** Utilize steps on page 87 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Changing Pumping Modes from High-Pressure to Low-Pressure.		
1. Can trainee perform procedures for changing pumping modes from High-Pressure to Low-Pressure? **Trainer Note:** Utilize steps on page 89 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Changing Pumping Modes from Low-Pressure to High-Pressure.		
1. Can trainee perform procedures for changing pumping modes from Low-Pressure to High-Pressure? **Trainer Note:** Utilize steps on page 89 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Fuel Low-Pressure Transfer Operation Without the FSU.		
1. Can trainee perform procedures for fuel low-Pressure operation without the FSU? **Trainer Note:** Utilize steps on page 91 to assess trainee knowledge.		

Performance Checklist used by the Trainer/Certifier (Cont.)		
Step	**Yes**	**No**
Procedures for Emergency Shutdown of the FSU and PFTU.		
1. Can trainee perform procedures for emergency shutdown of the FSU and PFTU? **Trainer Note:** Utilize steps on page 92 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Normal Shutdown of the FSU and PFTU.		
1. Can trainee perform procedures for normal shutdown of the FSU and PFTU? **Trainer Note:** Utilize steps on page 93 to assess trainee knowledge.		
Step	**Yes**	**No**
Procedures for Fuel Temperature Warning Response.		
1. Can trainee perform procedures for fuel temperature response? **Trainer Note:** Utilize steps on page 93 to assess trainee knowledge.		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

MEMORANDUM FOR HQ AFCESA/CEOF
139 Barnes Drive Suite 1
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

   Module # and title_____

2. Identify improvement/correction section(s):

   _____ STS Task Reference
   _____ Training Reference
   _____ Evaluation Instructions
   _____ Performance Resources
   _____ Steps in Task Performance
   _____ Performance Checklist
   _____ Feedback
   _____ Format
   _____ Other

3. Recommended changes--use a continuation sheet if necessary.

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. You may choose to call in your recommendations to DSN 523-6380 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position